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Preventive Inspection

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The fewer the rejections, the better the inspection—paradoxical but true. The inspector's real job is to prevent the necessity of making rejections. And when something does go wrong his duty does not end at merely saying so. He should discover why. Mr. Ross recommends a unified department responsible to a coordinating executive who can keep the inspectors working with, not against, the shop, and vice versa

HOW OFTEN, when we think of an inspection department in a manufacturing establishment, do we think of it in glowing terms or consider it an important contributor to the company's welfare and profit?

Perhaps not often, for doubtless the first inspector in name was born of customers' complaints about unsatisfactory products, and 'the dog' has had a bad name ever since. Unfortunately like a dog, many an inspection department has barked, growled, bitten, snooped around, and eaten its head off without return to its owner.

Present-day management, however, carries the simile a step farther. It believes that by proper selection, by training, treating, and feeding the dog right, it will amply repay its master for all his investment of time and money. It will guard his property, prevent losses, and point his profits.

When the idea of inspection was conceived, it is probable that the first inspector was placed in the packing room or shipping department to see that the goods as shipped were right. Doubtless, when some were found incorrect and were returned to the assembly department for reassembly, it became apparent that an inspector should be there to prevent improper assembly and thus save the cost of tearing down and reassembling. Next, and by the same reasoning, an inspector was probably placed in the machine shop and then in the receiving department. Thus the whole plant was covered by inspectors and an inspection department had grown up, like Topsy.

The loose organization and procedure of many inspection departments today bespeak just such beginnings. Unfortunately the original purpose of inspection, that all-important one of prevention, appears to have been forgotten. However, if maximum profits are to be made, the inspection department must contribute its share by operating at minimum expense just the same as any other.

Profitable inspection requires a carefully organized department working in close cooperation and harmony between and with all others. In fact, its function is more one of service to other departments than it is of inspection because the other departments produce quality, the desired result, and the inspection department merely assists in various ways in attaining that end.

Fundamentally, the quality of the product depends upon the quality of the design, the materials used, the machine and tool equipment, and the skill of the producers. It does not depend upon the ability or efforts of the inspectors to detect faulty products. The type of inspection department with which this article is to deal recognizes this fact and directs its principal efforts towards the prevention of defective materials getting into the product and of defective workmanship being done upon it. It is just another application of the old adage about an ounce of prevention being worth a pound of cure that makes this type of inspection profitable.

As a concrete example of the results of the application of this principle of prevention as applied to inspection, a certain plant where it has been applied had an inspection staff of thirteen men loosely organized and badly equipped. Labor losses on defective material, material

and labor losses from defective workmanship, and losses due to faulty blueprints, specifications, etc., amounted to approximately $14,000 per annum. The department was reorganized and its efforts directed towards the prevention of losses instead of detection of faults. At the end of the first year the annual loss had been reduced by $5,000 and the inspection personnel to eight! At the end of the second year, the losses were reduced $2,000 more and the personnel to seven, a saving of approximately 50 per cent in losses and about 40 per cent in inspection cost. Labor was not reduced quite in proportion to the personnel because inferior inspectors were dropped.

The first essential in organizing a department of this kind is to fix its responsibility to some officer or higher authority of the company who truly appreciates the aims and attitudes of the company's various departments; production, sales, service, and financing. Such a man will be able to coordinate all the various efforts to control quality, and will direct inspection, without partiality, for the best interest of the business as a whole.

The second essential is to select as chief inspector, a man with an abundant supply of tact and judgment who can work in harmony with the heads of other departments, high and low, and thus secure their cooperation to stop and prevent faulty production.

A good knowledge of the product is desirable, particularly concerning its ultimate use. His decisions must be made with that in mind, but it is not necessary that he be highly skilled in the use of inspection tools any more than an office manager need be a good typist. Technical ability may, however, be helpful if he has to train his own subordinates.

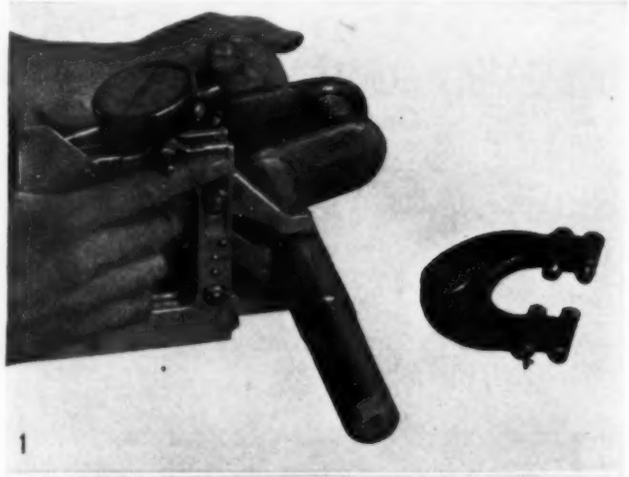
Mental Attitude Important

The personnel of the department should also have a good supply of tact and judgment together with technical knowledge of the application of the part of product with which they are concerned. But above all their mental attitude is important. Inspectors must realize that their function is primarily to prevent trouble and not to detect it, that their job is to help the production department turn out good material and workmanship and not to proclaim its failure. The fewer the rejected parts, not the greater the scrap account, the better.

The inspector must be friendly and not crabbed even when trouble is found, and he must be firm without being arbitrary. Just as more flies are caught with molasses, more success is assured in preventive inspection with harmony and friendliness.

The third requisite of the department is authority to inspect and pass judgment upon the product from beginning to end, and to stop production on any job or machine at any time when unacceptable parts or units are being produced. These may appear rather extreme, but responsibility without authority is like taxation without representation, and the scheme does work out satisfactorily even where the inspection department has to refer certain work, such as chemical analysis and physical tests, to other departments for reports, at the same time retaining final responsibility.

In one plant where preventive inspection is now practiced, the inspectors originally had little more than advisory power. As a result the shop did about as it liked and quality was extremely variable. When it was first proposed that the inspectors be given authority to stop machines when quality was not up to standard, the management was very reluctant in granting it. The first couple of times machines were stopped, the departmental foreman flew into a rage and went over the head



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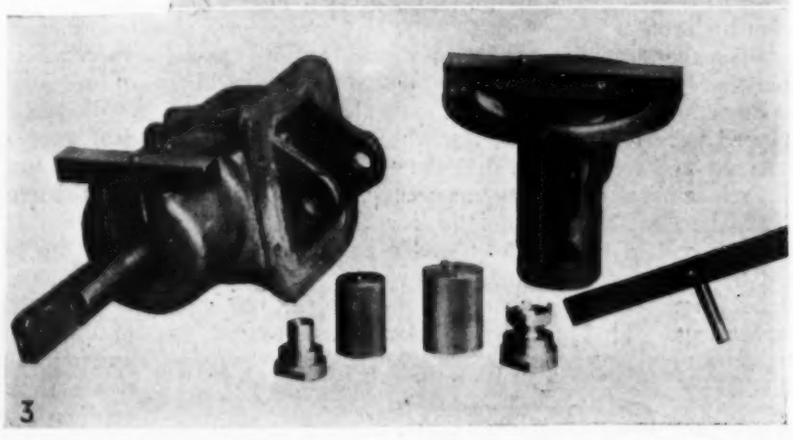

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Fig. 1—The old and the new—two types of gages for inspecting outside diameters. Fig. 2—Visual impressions are faster and more accurate than those conveyed by sense of touch. Fig. 3—There are exceptions to every rule, a feeler gage is indispensable at times. Fig. 4—Sweep gages answer the purpose admirably on certain classes of work

of the chief inspector with his complaint about production being stopped; but when the chief engineer went back to the shop with him, investigated the trouble at first hand, and explained how costly it would be in assembly to correct the difficulty and how serious the trouble in the field might be, the foreman put his shoulder to the wheel, corrected the difficulty, and the work went on. Today machines are seldom stopped in that plant, and when they are, the inspector's action is seldom questioned or the chief inspector ignored.

Another requirement of profitable inspection is proper inspection equipment. Just as much consideration should be given to the selection of tools for the inspection department as for any other department of the plant, for although inspectors' wages are charged into burden accounts, they are just as much a part of the cost of the product as those of the producer at the machine.

Proper Equipment Saves Time

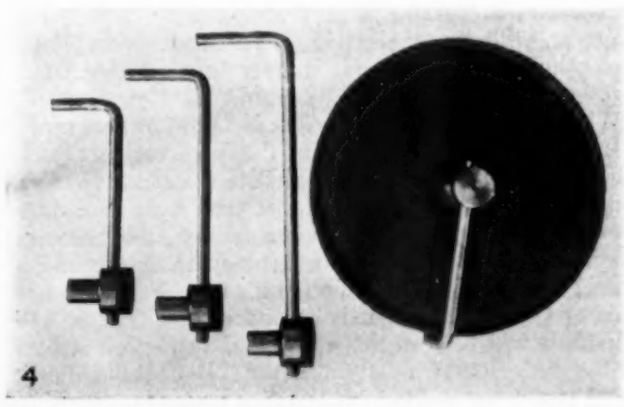
Standard and direct-reading equipment is generally preferred because it is both more adaptable and quicker to operate. Fig. 1 shows an old style go-and-not-go snap gage and a modern direct-reading external gage. Fig. 2 shows an old style go-and-not-go plug gage and a direct-reading internal gage. It is probably not exaggerating to say that, with the up-to-date gages, an inspector can inspect several times as much material in a given time. Where selective fits are to be made, these direct-reading gages are almost invaluable.

Sometimes special gages will do work more quickly than standard ones and when such is the case and the production quantity warrants it, they should be furnished. Fig. 3 shows a whole family of special-purpose feel gages for checking depths. They consist of a pin with limited travel in a bar or sleeve, the top surface of which is at two different levels. When the depth being gaged is correct, the upper end of the pin is between the two top levels of the bar or sleeve.

Fig. 4 shows a family of sweep gages for checking the diameters of large disks where the maximum diameter only is important.

Space does not permit a lengthy discussion of inspection equipment, nor is such the purpose of this article. The foregoing illustrations are merely to develop two important and desirable features, the first being the selection of accurate, close, and direct-reading equipment, the second, time-saving equipment.

In the practice of preventive inspection, to secure or approach 100 per cent efficiency, it must start where manufacturing expense starts. In the Kellogg plant it starts where blueprints of new or revised designs are



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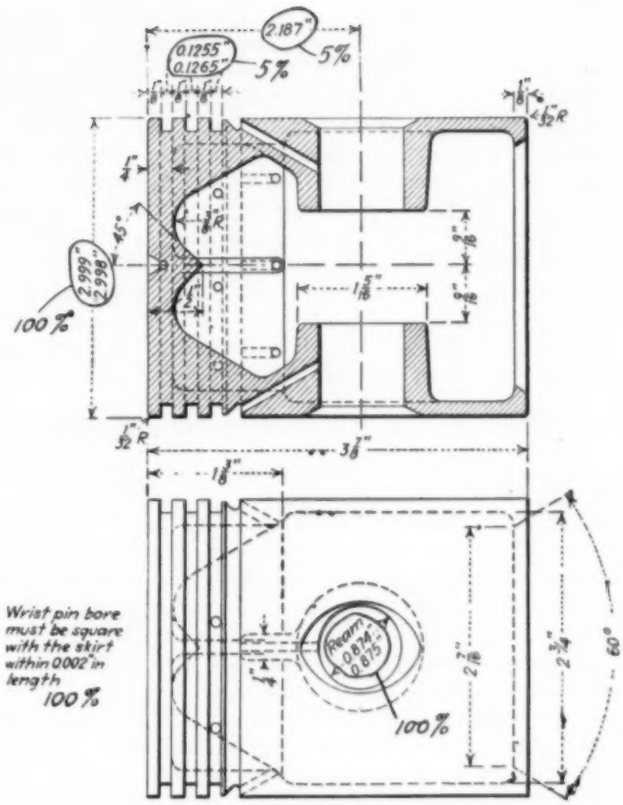

Fig. 5—The important dimensions on each print are circled, and the percentage of a particular dimension that shall be inspected is indicated

first issued from the engineering department to the pattern shop, tool department, or purchasing agent, and continues to the shipping department door.

The chief inspector is sent blueprints as soon as they are issued to any other department. These he studies for several purposes: first, to detect any shapes, dimensions, finishes, etc., which may cause trouble in the shop or elsewhere either for the purpose of questioning the engineering department concerning them or to warn his inspectors, the purchasing or production departments; second, to get an idea of what dies, patterns, tools, sample castings, etc., may be expected for inspection; third, to determine what inspection tools and equipment are going to be required so any not on hand can be ordered; and fourth, to circle on the prints those dimensions which are important for his inspectors to check to insure proper fits, alignments, and interchangeability and to make such other notes of warning or instruction for the inspectors as may seem desirable.

In connection with the circling of the dimensions to be checked, it has sometimes been found convenient to indicate with a percentage figure, what proportion of a lot should be checked. Fig. 5 shows a blueprint of a piston marked as suggested. Such marking saves hours of useless checking and permits concentration upon those dimensions which are important.

Preventive inspection, at its best, has a further responsibility preliminary to actual manufacture in that it is responsible for the accuracy of new dies, patterns, tools, and fixtures. These are the agents primarily responsible for keeping the product in accordance with the design. The inspection department is not to be made responsible for the maintenance of these things, but it should be empowered to order corrections to them when necessary

to insure proper performance. For instance, a pattern becomes warped and consequently the castings are not true, or perhaps a drill jig becomes so worn that hole centers are not maintained and convenience of assembly is threatened. In such cases the inspection department should be empowered to order or, at least, to initiate the order for the necessary corrections. This type of work, as was said before, is preventive inspection at its best.

In inspecting these things, particularly tools and fixtures for repetition work, it has been found desirable to insist upon a considerably greater degree of accuracy than is required in the product. This costs relatively little more in the tools and fixtures and greatly prolongs the time before wear makes rebuilding necessary.

When Should Product Inspection Begin?

Product inspection should usually begin with material as received, but in some cases, the purchaser should actually have material inspected before it is shipped to him. This is particularly true where the transportation charges constitute a large part of the cost, and where rejections of even part of the shipment at destination might cause serious and costly delays in meeting schedules. One New England purchaser of California pine sends an inspector to the coast each year to inspect its year's supply of lumber as loaded. This insures the purchaser that the amount of good lumber in the shipment as received is up to the quantity ordered and eliminates duplicate shipments, perhaps at increased freight rates, to replace rejected quantities.

The failure of purchased goods to measure up to the purchaser's desire is doubtless due in most cases to faulty or incomplete specifications on or accompanying purchase orders regarding which the vendor is in complete ignorance. It is doubtful if there is one shipper in fifty who would willfully send a customer something which he knew would be unacceptable or even acceptable but unsatisfactory.

To insure the receipt of proper material it is necessary that the vendor shall have complete information.

Purchasing departments are sometimes jealous of their contacts with vendors, but the shrewd chief inspector will tactfully break down such barriers by a spirit of cooperation and helpfulness so that he can contact directly with vendors, as desired, with the aid of the purchasing department.

These direct contacts, sometimes by trips to the source of supply, offer the best possible opportunities for the establishment of complete understandings between vendor and vendee concerning what the latter wants and what the former can supply. A few spoken words and personal contact often prove of greater value than pages of specifications.

When faulty and unacceptable goods do arrive, there is nothing to do but to return them to the vendor, but often things are not exactly as desired and yet are acceptable. Even in such cases, it frequently serves a good purpose to return one or a few samples as a concrete example of what is undesirable.

The completeness of inspection of purchased materials should depend entirely upon circumstances, if economical inspection is to be attained. In some cases, and particularly where one is dealing with a high-grade source of supply, inspection may be a waste of good time because of the high standard and uniformity of the particular product. In other cases the most exhaustive tests may be necessary, even to the extent of making chemical and spectroscopic analysis, because of the extreme requirements of the material in the finished product or for other reasons. In the manufacture of air-compressor units, there are some articles, particularly electric motors, tanks, and pressure gages, which it is more convenient and economical to inspect and test after they are completely assembled in the finished product. In many other products, doubtless, there are similar parts the inspection of which can most profitably be made, not when received, but at some subsequent stage of manufacture.

These many and variable circumstances concerning purchased materials offer the chief inspector the widest opportunity for getting his work out of the doldrums and into the realm of scientific management with minimum cost of operation.

In production departments where the inspection department has to deal primarily with the quality of labor rather than with that of materials, preventive inspection, as its name implies, again aims and strives to prevent trouble rather than to detect it. In the Kellogg plant, as has been previously suggested, the inspection department checks all new patterns, dies, jigs, fixtures, and tools. While these things are not regularly inspected after once being approved, the inspectors do keep an eye upon them in order that their products may be right.

In the efforts towards prevention, inspection is mostly floor work, that is, it is conducted principally at the machine or work bench and not in the inspection department proper, except such things as cannot be conveniently checked elsewhere. Although floor inspectors do check work currently as it is produced, their chief concern is for the first pieces produced, and efforts are made to furnish producers with the means to check their own work whenever possible and practicable throughout the duration of the job.

Creating Respect for Inspectors

Constant efforts are directed towards the instruction of inspectors concerning the manufacturing and service problems and difficulties of the articles they are watching so that they can pass this information along to the producers for a more complete understanding of the requirements of the job. This creates respect for the inspectors and interest in the work in the minds of the operators far more than the mechanical following of a blueprint.

When jobs do go wrong, the inspection department does everything possible within its province to determine the underlying cause and to get it going correctly again, realizing that the next worse thing to producing incorrect material is to produce none. It will contact directly with the foundry in the case of hard or poor castings, with the tool department if the jigs and fixtures are incorrect, with the engineering department if drawings need changing: in a sense it is a service department for the production departments.

When, at final test, the product is found to be wrong, it is not ordinarily sufficient for the inspector simply to reject it. He must, if possible, indicate the exact nature and location of the trouble so that the repair man does not have to hunt for it. When the same trouble becomes too frequent, the inspection department takes the initiative in determining the underlying cause, lead where it may, and in seeing that it is eradicated.

Thus it will be seen that preventive inspection strikes at the very source of troubles, and if ever "a dollar saved is a dollar earned," preventive inspection earns it.

Experiments in Metal Polishing

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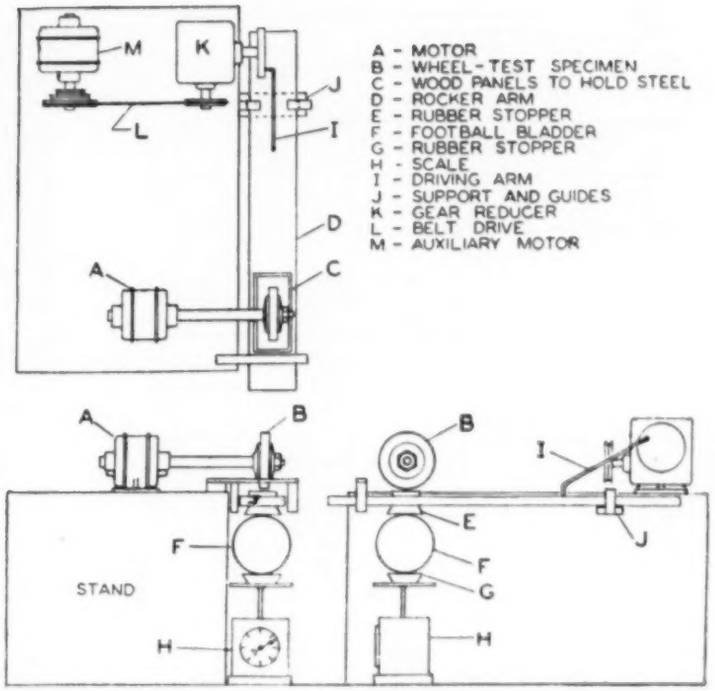

A - MOTOR
B - WHEEL - TEST SPECIMEN
C - WOOD PANELS TO HOLD STEEL
D - ROCKER ARM
E - RUBBER STOPPER
F - FOOTBALL BLADDER
G - RUBBER STOPPER
H - SCALE
I - DRIVING ARM
J - SUPPORT AND GUIDES
K - GEAR REDUCER
L - BELT DRIVE
M - AUXILIARY MOTOR
STAND

Fig. 1—Experimental polishing apparatus

Effects of pressure, grain size, and glue concentration upon the speed of cutting and efficiency of flexible wheels when polishing steel preparatory to plating, as determined by research

TO DETERMINE the effect of such factors as pressure against wheels, grain size, and glue upon grinding efficiency with flexible wheels the experimental polishing apparatus shown in Fig. 1 was used in tests conducted at the University of Michigan. The five-in. grinding wheel *B* having a ¼-in. face was driven at 5,900 r.p.m. or 7,000 ft. a min. peripheral speed. Steel to be polished was supported on the wooden arm *D* which was urged upward against the wheel by inflating the rubber bladder *F*, resting on scales *H* which after allowance for tare, measure the pressure of the work against the wheel. This pressure was varied by changing the degree of inflation of the bladder.

Wheels tested were cut from sections of buffing wheels and stiffened with glue to give them about the same characteristics as polishing wheels used in commercial practice. Peripheral threads were ripped to make them loose and flexible. After impregnating with a 30 per cent glue solution, wheels were dried and trimmed to give a smooth periphery. Finally a thin layer of glue was applied to the periphery and edges. Factors controlled in this procedure included: (1) Characteristics of glue used; (2) Concentration of glue solution; (3) Length of time that glue is soaked previous to melting; (4) Temperature at which glue is melted; (5) Length of time glue is held at melting temperature; (6) Temperature of glue when it is applied to the wheels; (7) The amount of glue applied to the wheels; (8) Kind of abrasive used; (9) Size of abrasive used and its screen analysis; (10) Temperature of grain at time of application to wheel; (11) Method of application of grain on the wheel; (12) Subsequent treatment of wheel previous to test; (13) Temperature and humdity of air during the drying process; (14) Length of drying time.

After applying the glue, the wheel was rolled for 30 sec. in the abrasive grain on a clean flat surface and dried for two hours. Then a second coat of glue and grain was applied and dried, and after another two-hour drying a final coat of "top-dressing" glue was applied and dried for 20 hr. Tests were then conducted. Conclusions reached are based upon the weight of steel ground off, not upon the degree of polish obtained. The latter subject will be discussed in a later publication.

The cost of glue and grain used in doing a definite amount of polishing is a measure of glue and grain efficiency and can be expressed as the ratio of the grams of steel removed from the steel bar to the grams of "wheel wear," or to the grams of glue and grain removed from the wheel during the polishing operation. This ratio referred to as wheel "efficiency," was determined by weighing both the wheel and the work before and after the test.

"Cutting speed" is defined as the steel removed per minute, per cm. width of the wheel, per kilogram of net pressure. This definition is fundamental and for that reason is used in spite of the fact that in the actual calcu-

Condensed from a paper presented before the Electrochemical Society, Birmingham, Ala., April 23-25, 1931.

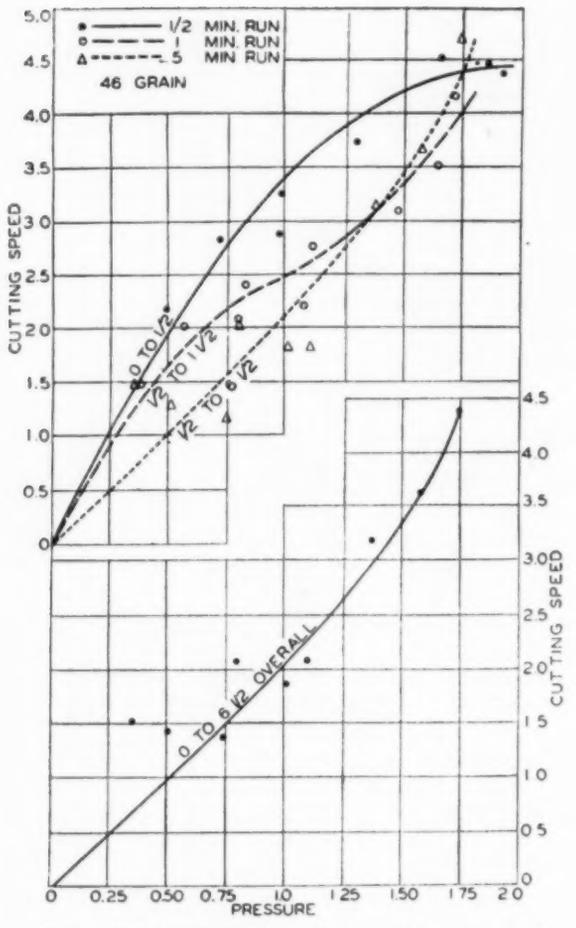


Fig. 2—Relation between cutting speed in grams of steel per minute per cm. width of cut and pressure in kg. per cm. width of cut

lation of cutting speed, the width of the wheel can be cancelled, and, therefore, the cutting speed could be expressed as the grams of steel removed per minute per kilogram of net force applied.

Tests were interrupted at intervals to trace the change in the performance of the wheels as they wore down, the intervals chosen were the first half minute, the succeeding minute, and the succeeding five minutes. By the time the wheels had run 11.5 min. at the pressures used in most of the experiments they had ceased to give representative performance.

Roughing wheels (set up with the coarser grades of grain) may be run only about 15 to 30 min. of actual polishing before they are worn out and need to be set up again. Finer wheels last much longer, usually several hours. Wheel life depends upon the pressure, as will be evident from some of the following data.

Fig. 2 presents the results of experiments in which the wheels were set up with two coats of No. 46 grain, using a properly prepared 30 per cent glue solution and afterward a thin coating of 25 per cent glue solution. Four curves show the performance of wheels at different pressures during the first half minute of the life of the wheel, the subsequent one minute, the subsequent five minutes, and the first six and one-half minutes. The latter curve, therefore, represents the average performance. Cutting speed increases approximately directly with the pressure exerted between the wheel and the work to be polished. Doubling the pressure, therefore, approximately doubles the cutting speed.

Fig. 3, representing the same runs portrayed in Fig. 2, shows a plot of efficiency, or the grams of steel polished away per gram of wheel wear. When the pressure is in excess of 0.75 to one kg. per cm. width of cut, the wheel efficiency decreases rapidly with increased pressure.

The life of the wheel at two kg. pressure would be around 25 per cent of the life of the wheel at one kg. or, by using a pressure of one kg., four times as many pieces could be obtained per wheel as with two kg. Fig. 2, shows, however, that the speed at which the polishing could be done would be only half as fast at one kg. as at two kg.

With grain No. 150, set up with 26.6 per cent glue

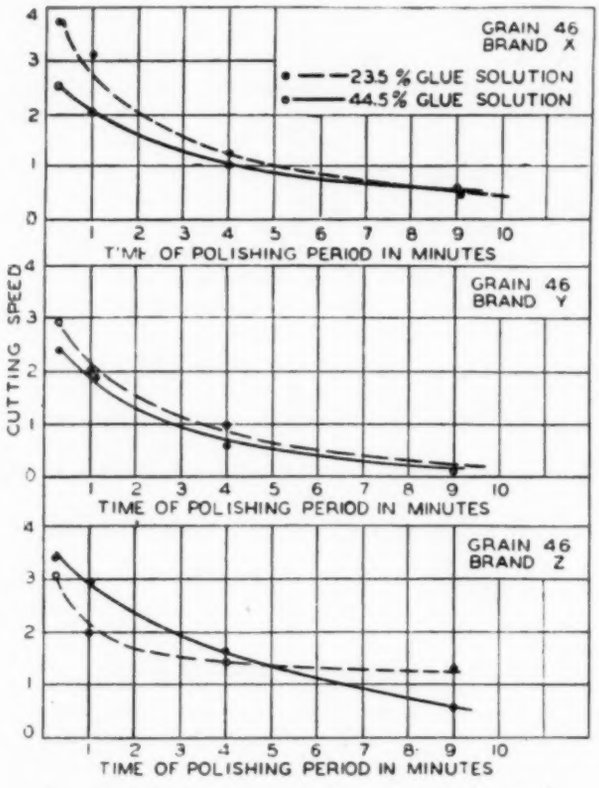


Fig. 3—Relation between time of polishing and cutting speed in grams of steel per minute per cm. width of cut

and given a top-dressing of 7.8 per cent glue, increased pressure only slightly decreased the efficiency, and except for the first half minute of polishing, an increase in pressure beyond 0.5 kg./cm. had very little effect on the cutting speed.

To determine the effect of closely sized polishing grain as compared with loosely sized polishing grain, experiments were run at a constant pressure of 0.86 kg. per cm. width of cut. Within the accuracy of the experiments, the sizing had relatively little effect upon the cutting speed. It did, however, make a great difference in the efficiency. Using 40 per cent glue, two and one-half times as many pieces could be obtained with this closely sized grain as could be obtained with the same amount of wheel wear when using loosely sized grain. The same general comparison holds for any other concentration of glue.

The performance of polishing wheels changes as they are being used. The change in the cutting speed and efficiency with time of polishing is shown in Figs. 3 and 4 for three different brands of No. 46 polishing grain.

Curves are shown for two concentrations of glue in each case. Results for intermediate glue concentrations lie in general between the results for the curves plotted, which show both a rather dilute glue and a rather concentrated glue. In all cases the speed of polishing decreases rather rapidly during the first few minutes that the wheel is used, and levels off to rather steady performance which may continue until the wheel is worn down to the canvas. But all of the brands of grain do not perform alike. At the end of a 10-min. interval, for example, brand *Z*, using the more concentrated glue, is decidedly superior in cutting speed to brands *X* and *Y*.

Brand *Z* in Fig. 4 shows little change in efficiency with the dilute glue, but a noticeable increase in efficiency with the cencentrated glue. Brand *X* shows a decrease in

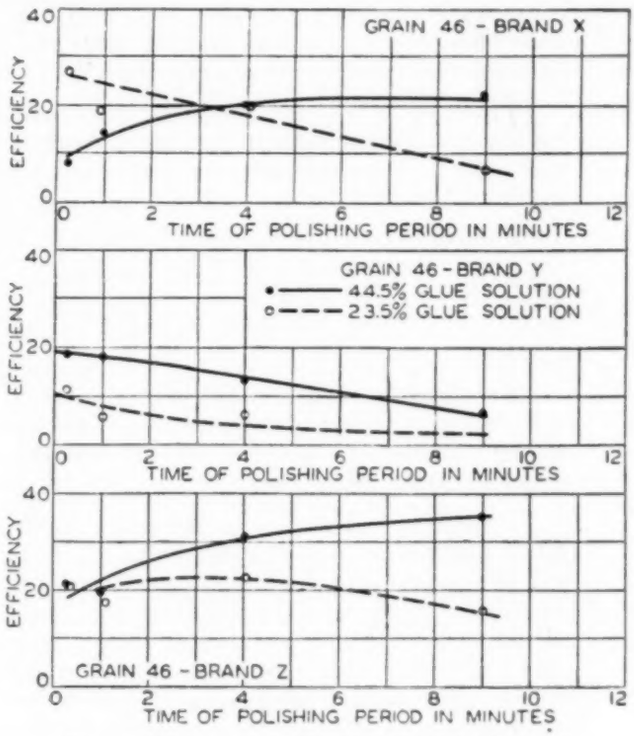

GRAIN 46 - BRAND X
EFFICIENCY
TIME OF POLISHING PERIOD IN MINUTES
GRAIN 46 - BRAND Y
44.5% GLUE SOLUTION
23.5% GLUE SOLUTION
GRAIN 46 - BRAND Z

Fig. 4—Relation between time of polishing and efficiency in grams of steel per gram of wheel wear

efficiency with the dilute glue. The efficiency also increased with time when the concentrated glue was used. In general, with the dilute glue, which does not hold the grain in place with sufficient tenacity, the efficiency is apt to decrease as the wheel is used.

Fig. 5 shows the relation between the concentration of glue in the top dressing and the efficiency and the cutting speed obtained with wheel set up with No. 46 grain. The more concentrated glue gives increased efficiency, the latter being three times as great with 30 per cent glue in the top dressing as it is with 10 per cent glue. But more concentrated glue does result in decreased cutting speed, particularly during the later parts of the wheel life. The decrease in cutting speed is, however, overbalanced by the increased efficiency resulting from the use of more concentrated glue in the top dressing.

With No. 150 grain the efficiency is decreased rather than increased when increasing concentrations of glue are used for top-dressing wheels set up with this fine abrasive. The cutting speed is also materially decreased. From these and many similar data, which are not presented here, we have arrived at the conclusion that top-

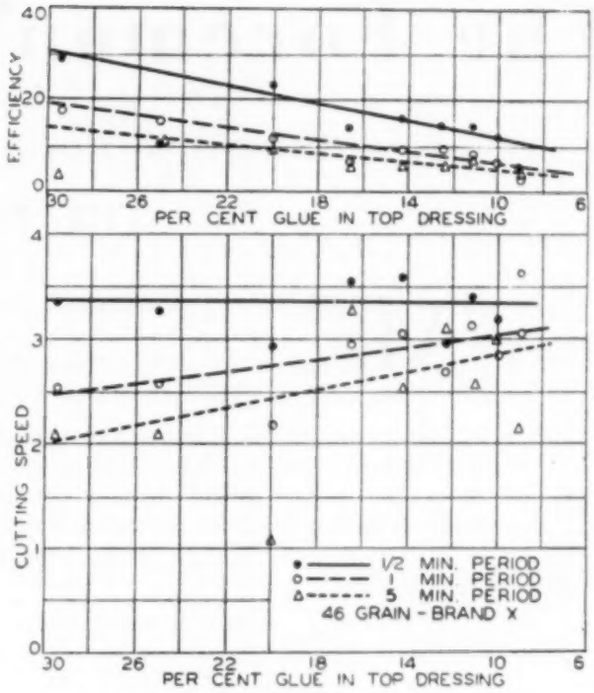


Fig. 5—Relation between glue concentration of top dressing and efficiency and between glue concentration of top dressing and cutting speed in grams of steel per minute per cm. width of cut, using 46 grain

dressing is well worth while for wheels set up with 100 grain or coarser grains, but that it is disadvantageous rather than advantageous on the finer grain sizes.

More precise results than those here reported probably can be obtained by using full-sized commercial polishing wheels with an experimental equipment similar to that here described, in that all the variables entering into the problem may also be carefully controlled. The use of full-sized wheels would eliminate any question of the direct applicability of the experimental results to practice. Such a research has been initiated by one manufacturer of abrasives, who is conducting an ambitious study of metal polishing with flexible wheels.

■

"THE automotive industry has been a pioneer in the development of economical mechanical handling and the centralization of authority for this service is common in many plants. It is not so common, however, to find the application of wage incentive plans to this type of work. In the use of mobile equipment there exists a distinct human factor, and due attention to the personal equation is productive of remarkable results. The Norton Company introduced a simple bonus plan based on the number of loads per day handled per truck. The number of trips per day per man was stepped up from 30 to about 60; the labor cost per trip was cut from 14c. per trip to 8c., and the earnings per man increased 35%. If the cost per ton moved can be made approximately equivalent, it is preferable to pay this cost in wages rather than in interest and depreciation charges, particularly where obsolescence may be an important and unknown variable."—*C. B. Crockett, in "The Place of Electric Industrial Trucks in the Handling System of Automotive Plants," an S.A.E. Production Meeting paper.*

The Foreman's Round Table

THE DEADLINE

"MORNING, Al. Want to go fishing with me this week-end?" hailed Ed as the two friends met at the factory gate on the way home.

"No, thanks. When I want excitement like fishing, I make a dot on the white table cloth with a lead pencil, then I get me an interesting book and I watch to see that dot move. Just like fishing, but a little more comfortable."

"Is that so? You will never know what excitement is until you feel a big trout strike and try to land him with a small line."

"Maybe, but I already know the deadly monotony of not having them strike. My system is best, because it reminds the lady I live with to go out and buy a mesh of fish. Besides, I don't drink."

"You're thinking about medicine for snake bite. No fisherman wants to cure fish bite. By the way, where are you going on your vacation this year?"

"I haven't made up my mind yet. Maybe I won't get any vacation."

"What do you mean, you won't get any vacation? Going to quit?"

"No, but Williams is getting out a standard practice order on vacations. Didn't you get an advance copy and an invitation to make comments?"

"Maybe I did, but I thought it was just another pill and didn't pay much attention to it. What did it say?"

"As I recall, it said that general foremen would get two weeks, foremen and assistants one week. Anyone on salary that does not receive pay for overtime, will be allowed a vacation equal to double the authorized overtime they work, but not to exceed the vacation allowed their immediate superior, or the foreman of the department."

"What does all that mean? We haven't any general foremen, and why shouldn't the clerks get the same vacation they always had?"

"One thing at a time, Ed. A note at the bottom of the order says that for vacation purposes a general foreman is one who has either another foreman or one or more recognized assistants working under him."

"Oh, I see. It's cheaper to hire them as assistant foremen, but why cut out the other vacations? My clerk deserves a vacation as much as I do."

"I think so too, Ed, but does he deserve a vacation more than your best mechanics? Does he do anything that a good mechanic does not? Does he work as hard or as steady?"

"Maybe not, but it's a different kind of a job, and they always had a vacation. They're going to give the general office force the usual vacation, ain't they?"

"Probably. A shop executive has to be guided by reason not by precedent. A clerical job where the man is doing important repetition work is fatiguing, but our shop clerks are doing different things part of the day and nothing the rest of it. They do not know what mental fatigue is. They suffer from ennui. They base their claim to a vacation on the fact that they do not get paid for overtime. To be square, Williams will allow them double time for overtime. To be square, however, does not mean giving people everything they think they want; it means, among other things, taking privileges away from the special few that have no title to them, save custom."

"This place will be a regular madhouse soon. It's a wonder Williams didn't do away with all vacations."

"He did cut yours, Ed. The notice says that, 'One week's vacation does not mean from Saturday morning until a week from the following Tuesday morning.' That hits you hard, Ed. I'm sorry."

Where is the logical deadline for vacations with pay? What constitutes mental labor that deserves or demands a vacation? Is there any logical reason for allowing routine workers in the office a vacation?"

▸ ▸ ▸ Discussion of Former Topics

Direct Action

I am agreed that Williams, as general superintendent, should be placed on an equality with the heads of other divisions. The tendency of management to perpetuate itself in kind through the old fashioned custom of confining executive control to those who have ascended the ladder of office success is as obsolete as the theory that a good shop executive must of necessity be a "rough neck" and a driver. As a matter of fact, the current tendency for some college men to go into the shops, often produces shop executives who are better fitted as contact executives than many an office executive who has worked his way up by the blustering methods that are no longer found desirable even in the shop. There is also one very important factor that is not to be slighted in these days of competition: the real general superintendent knows his products. In fact, he may even have a keener understanding of fundamental costs, etc. than the treasurer.

I am sincere in my belief, that the importance of costs and other clerical functions is often overemphasized. A good general superintendent or other shop executive can soon acquire the fine points of the office and management, but even a good secretary or treasurer can seldom acquire the intimate technical knowledge of his company's products that the shop executive has. This is not due to any inherent superiority of the shop executive as a man, but to the nature of the two forms of knowledge, which makes it impossible to acquire the shop end except by years of digging right down amid the chips and slushing oil. —Joseph Cheesman.

Bad Debts

If the company expects loyalty from its employees, it should stand by them in time of trouble.

Merchants should be notified that the company is running a manufacturing plant and not a collection agency.

If an employee has become deeply involved in debt, the company should, if requested, assist him in arranging settlement or in budgeting his income to enable him to pay his way out.

Deadbeats are almost unknown among workmen who are well paid. —J. A. Lockard, *Foreman, Armstrong Machine Works.*

Age and Its Compensations

Thirty years ago I came to London seeking employment. Meeting the "chief" at the factory gate I was asked what I could do. I told him that I was an all-round mechanic as well as a draughtsman and designer. He remarked that I must have made good use of my time. Well—I had. I was forty years old, had served my apprenticeship in a small shop, and had worked on fitting, machinery molding, and smithing in that little shop as well as in various other shops. He then asked me what rate of pay I wanted. I replied, "Nothing less than the highest rate for mechanics." "All right," he said—and I got it—and was foreman of the shop with proportionately higher pay in a few months. I stayed with the firm until I became principal foreman, with the highest foreman's pay.

The above is simply cited as a reiteration of Al's remark: "A man should be paid on the basis of what he is worth to the organization, and not on a basis of what men working around him get, or how old they are."

The writer holds a brief (all the time) for the skilled man. Such a man has no use for a system which lumps all men into one conglomerate whole, paying all a set wage. —J. T. Towlson, *London, England.*

Wide Open

The foreman's desk should be located at the rear. If a work boss or a workman wishes to talk with the foreman, he can glance over his shoulder and see if the boss is at his desk. The conscientious worker cares not a bit that the boss is in back of him. In fact the worker will lose himself in interest in the job before him and forget the boss quicker, especially if, when he glances ahead, he does not see the foreman's desk.

The advantages in having the foreman so located is that a worker does not feel that he is "going into the office" when he merely has to step back to the desk to see the boss. Both parties will act and talk more freely, thereby creating an unpurchaseable understanding. The foreman has his work in front of him and, with no dead-letter parking places, will keep his paper work up to the minute and facilitate the tie-in with the office.

—E. E. Gagnon, *Mechanical Superintendent, Raybestos-Manhattan, Inc.*

Tolerances

One would naturally assume that a tolerance is the greatest variation from the desired dimension which will be "tolerated." If this is true, the tolerance is absolute, for a slightly greater variation will not be tolerated. However, it frequently becames the habit to specify tolerances closer than is necessary, on the theory that the machine operator and the inspector will consider them as ideal and allow parts to pass which are not strictly within the limits. Such parts may fit at assembly except in a very few cases. Under these circumstances the first viewpoint would claim that the tolerances had been set too close and that they should have been made liberal enough to include all which were satisfactory. But the other side will object to allowing the operator more freedom when he is unable to keep within the present limits. The argument is that he will still continue to run slightly outside the tolerances. This is the same as

the objection to raising the automobile speed limit from twenty miles an hour to thirty on the ground that those who now drive forty will increase to fifty. Nevertheless, this attitude cannot be assumed to be absurd, as there are so many who believe in it.

It is my opinion that tolerances should be more absolute than ideal. The dimension from which the variation is allowed is the ideal. The tolerance shows the less desirable but possible size. All sizes beyond the tolerance shall be considered as unsatisfactory even though a few might pass without trouble. In order to determine the correct tolerances for these conditions the designer must have an idea both of the accuracy necessary and of the expense involved in maintaining close limits.

This does not mean that it is possible to determine accurately the tolerances for each individual piece. The standard tolerances of various classes which have been approved by the American Standards Association may be chosen if it is found that they are consistent with the shop methods. The engineer may then choose the class of fit. He should still know what extra cost is involved in the closer fits. —HARRISON G. BROWN,
Supervisor of Standards Division, Crompton & Knowles Loom Works.

Whistlin' Willie

Although for a number of years I have worked in a plant where noises vary from almost nil to the volume produced by a machine gun battery at short range, and in pitch from the highest to the lowest audible to the human ear, I have been unable to reach any general conclusions on the subject of the effect of noise on efficiency. It is not only the quantity but also the quality and pitch of the noise that counts.

Men have had nervous breakdowns, apparently as a result of a continuous noise of unvarying pitch but small volume. A choir of men, all of whom worked 48 hours per week in a terrific din, did very well at musical festival competitions. I have heard men singing with great satisfaction to themselves, oblivious to deafening noises around them even though their voices were perfectly inaudible a foot away.

—H. J. BURNHAM, *Birmingham England.*

The Stork's Assistant

Every manufacturer has a right to make medical examinations compulsory, provided he pays for the examination. Any doctoring required should be paid for by the patient. This benefits both the employer and the employee, and both should help towards making the examinations compulsory.

These examinations should be performed by the employer's physician on the employer's time. A copy of the doctor's findings should be given to both employee and employer, after which the employee should have his repairs made by a physician of his own choosing.

While the employer has a right to demand that his employees meet certain requirements physically, he should not assume the responsibility of specifying a certain doctor to do the repair work necessary to bring the employee up to the requirements.

In most lines of manufacture, an annual examination will suffice. However, the examination should be available to anyone in between times, should he feel it necessary.

Certain occupations may require the examination more frequently, and in these cases it should be given as often as found advantageous. —C. F. STAPLES.

A Friend at Court

It has been my experience that there is a definite tendency on the part of the "boss" to allow the friend to "get away" with a loss in efficiency of working which would not be tolerated with an outsider. This is likely to occur whether the friend is playing straight or not. Much depends on the attributes demanded of a man before he can be dubbed a friend. On the job, one's first duty is to the company, and if a friend is taken on as an assistant, there must be a definite understanding by the boss with himself, and preferably with his friend, that service to the company must be the first consideration.

The chances of ultimate satisfaction are doubtful, and I believe it is far better to keep one's friends outside of one's own department. The continuance of the friendship is at least not compromised. Many of us have one friend whom we are sure would not let us down, but only the fortunate fellow who has a wide circle of friends can afford to experiment with them.

—S. A. KNIGHT,
Tuz Khurmatu, Irak.

Gilding the Lily

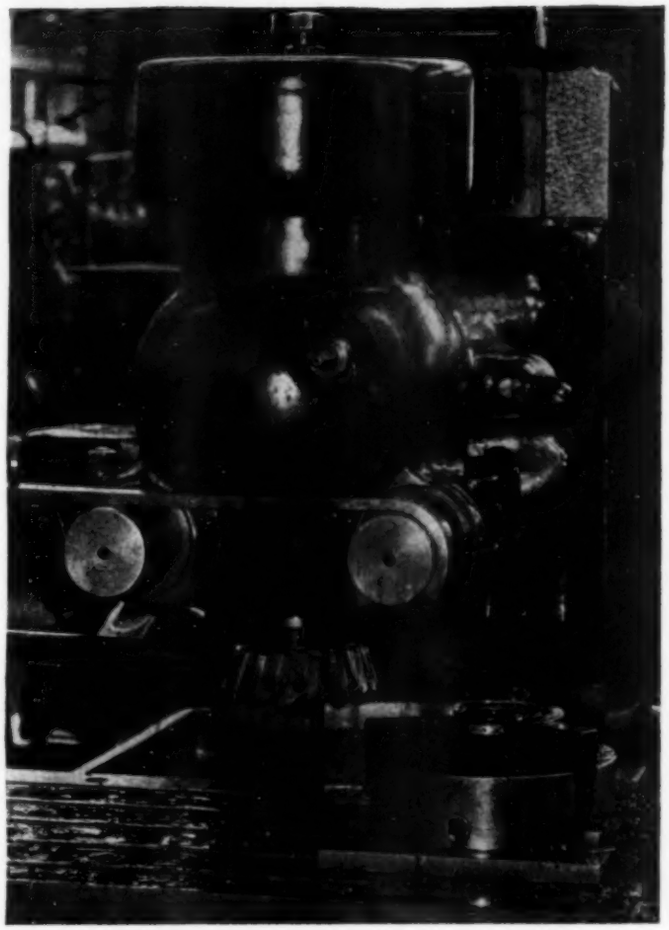
So Ed nearly had to fire a man to get him to use a pair of calipers instead of an outside mike on a roughing job? No wonder! If jobs had been more plenty he probably would have had to fire him, for no first class man wants to use slow obsolete methods when he has the tools to do the work in a better way. It is true that some people look on the mike as a difficult thing to use and one that takes an undue amount of time, but to an intelligent person practiced in the use of a mike there is nothing slow or complex about it.

Just compare the two methods. With the mike, a trial cut is taken. Then one measurement is made from which the machinist knows just how many thousandths more to take. He sets the dial on his cross feed, which is also marked in thousandths, and knows that the cut will come correct.

If he had used calipers, he would have needed two tools to do the work of one: he would have had to measure the work and then measure the calipers, or he would have had to set the calipers and then try them on the work. In either case it is more work, and the chances are that he would not have found the calipers and the scale on the same part of the bench or in the same drawer of his tool box. Then when he has made his measurements he cannot use the graduations on the feed without complex arithmetic, because his scale measures sixteenths and the feed thousandths. If he is required to make his roughing cut within fifteen thousandths, as is best practice in lathe work under 2 in. diameter, he will find it necessary to make quite a number of trial cuts, and even then is uncertain as to just how much he is taking. —A. W. FORBES,
Forbes & Myers

The Cutting Carbides

Latest Developments in Milling with Tungsten and Tantalum Carbide



Tantalum carbide cutter milling $\frac{1}{16}$ in. of material from a forged steel gear blank of SAE 3140 at a speed of 170 ft. per min., and a feed of 14 in. per min.

FRANK W. CURTIS

Research Engineer, Kearney & Trecker Corporation

MILLING with tungsten carbide has not kept abreast of its application to other metal-cutting operations. This is largely because early experiments failed to show comparable results. The cost involved was not justified because no guarantee of performance was offered. Attempts were made to follow cutter designs used for other metals and to use such cutters in machines unsuited for T. C. operation.

There is no question but what milling is one of the most outstanding T. C. applications. However, *success is entirely dependent upon rigidity*. There are just three factors that contribute in this respect; the cutter, the machine, and the fixture. Weakness in any one will offset the effectiveness of the other two. In milling, the total amount of metal to be removed is divided among several cutting edges, and each tooth is not taxed to any great extent. If the face of a workpiece required the removal of 1 cu.in. of metal, and a milling cutter having 12 teeth could do 3,000 pieces between grinds, then each tooth would only remove about 250 cu.in., but a small fraction of the life expected of a T.C. tool.

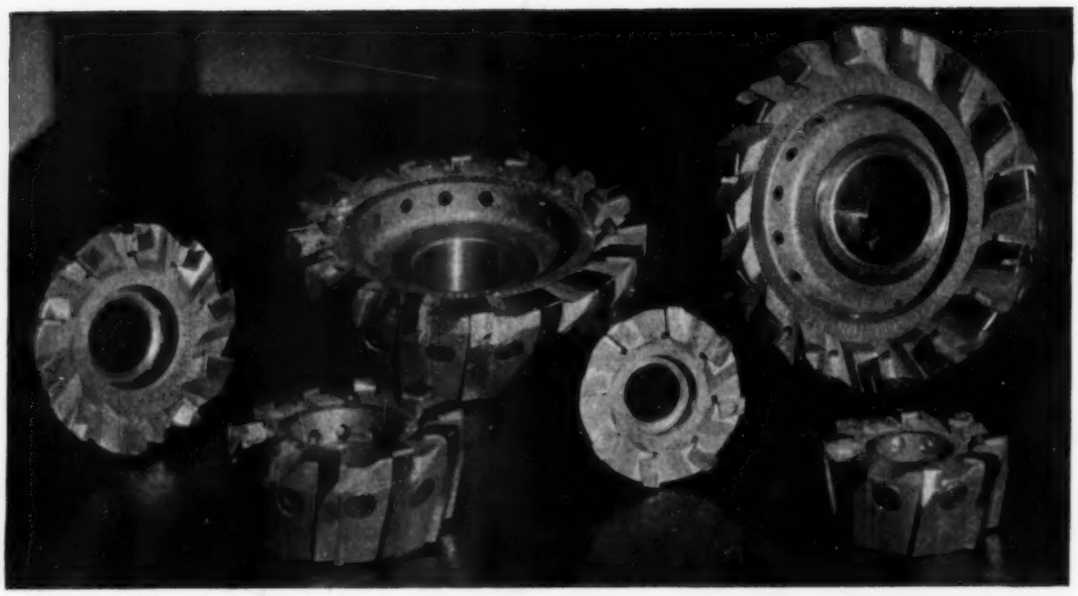
Milling cutters of the inserted-blade type, solid and rigid in construction, can be designed without much difficulty so that the full benefits of T.C. can be obtained. Cutters of this design are the most practical because all the features necessary for the use of T.C. can be incorporated. Solid-type cutters, such as small plain and side cutters, and end mills, have been used with unusual success, although their application is somewhat limited. With the conventional solid-type cutter—one having a number of inserts brazed solidly to a steel body—the replacement of a damaged insert becomes more of a problem. The high temperature required for brazing a new tip in place is such that it would have a tendency to loosen other tips. On this account, it is often necessary to rebuild completely a solid cutter when one tip becomes damaged.

In many cases, it is possible to construct a cutter with solid blades welded to the body. In this design, the small steel blade is milled out to receive the tip, which is brazed to it. The body is slotted to receive the blades which are pressed in place. Blades are tack-welded to the body, then the cutter is finish ground.

Inasmuch as a large amount of metal is removed rapidly with a T.C. cutter, it is natural to assume that sufficient strength is incorporated. The body should be as solid as possible, and the blades should be of heavy proportions to withstand faster feed rates. In addition to strength, there is a decided advantage in having hardened bodies in order to resist wear. Since so much depends upon proper support, it is highly essential that the blades be supported as close to the cutting edges as possible. The traditional practice of extending the blades beyond the face of the body is not suited for T.C. tools. Overhang causes a slight vibratory action which seriously affects tool life.

No attempt should be made to equip old cutter bodies with T.C. blades, because their performance will be disappointing. Every effort should be made to overcome the possibility of blades loosening during cutting. Positive locking is very desirable and must at no time be

An abstract of an S.A.E. Production Meeting Paper, entitled, "Latest Developments of Faster Milling With Tungsten and Tantalum Carbide Cutters."



Several T.C. cutters of the inserted-blade type. These cutters have been used to remove $\frac{1}{16}$-$\frac{3}{16}$ in. from cast iron parts at feeds above 50 in. per min., bronze up to 75 in. per min., and aluminum up to 100 in. per min. Blades in this type of cutter can be replaced easily if damaged

overlooked. Individual clamps or wedges are preferred. It is also desirable to back up the blades so that they cannot push away from the cut. This is obtained in several ways, one a backing-up plate that forms a support for the back end of the blades, or pins in the body and slots cut in the blades which give the same effect.

During the past three years, particularly during the past few months, those connected with the use, manufacture, or application of T.C. have come to realize that the use of machine tools of suitable design is one of the first requirements for successful application of the metal. This need is particularly important when milling is to be considered. Milling machines of the older types are not likely to offer the necessary strength and rigidity.

More power is required for T.C. milling cutters. When spindle speed is increased, power naturally increases with it. This is true regardless of the cutting material used.

In observing many castings from various foundries, it appears that better control of output would be advantageous from the standpoint of T.C. milling. Uniformity of size is perhaps the chief requirement. Allowances for machining must also be held within safe limits, or the machine may stall, resulting in possible damage to the cutter.

With T.C. tools, accuracy is not necessarily sacrificed; it may often be bettered. Cutting pressures are usually reduced, with the result that closer tolerances can be maintained. T.C. cutters, operating at higher speeds, frequently enable better finishes to be obtained, due to the slight reduction in feed per tooth per revolution in spite of the faster rate of feed made possible. Less distortion also takes place in milling with T.C. due to higher speeds and reduced cutting pressures. There is also a reduction in heat generated at the cutting face. Higher speeds also greatly lessen the danger of chipping or breaking away at the corners and edges of castings. This chipping often necessitates the reduction of feed when slow peripheral speeds are used. Roughing and finishing operations may possibly be combined in one cut. Also, annealing can sometimes be eliminated.

Milling fixture design appears to stand out quite prominently among the important changes to accompany the use of T.C. Improved methods of clamping are obviously needed. Quick-operating, highly fool-proof clamping devices are essential. In many cases the loading time of an operation will have to be reduced in proportion to the reduction in machining time in order that the full benefits of T.C. may be obtained. This means entirely new fixture designs. The question of expense must, of course, be considered, but here again the returns will more than compensate for the added cost of a new or improved fixture.

Experience has shown that the rake and clearance angles for T.C. turning tools should be reduced slightly from the conventional angles used for high-speed steel. The same practice is carried out for milling cutters. A typical cutter for machining soft or medium cast iron has a face angle of 6 deg., a rake angle of 3 deg., and bottom clearance of 3 deg. The angle on the periphery, or outside diameter, should be sufficient to clear the work so that the heel of the blade will not drag. Usually 5 deg. will suffice. These angles can be altered slightly one way or the other without serious variations in cutting efficiency, life between grinds, or horsepower consumption. For example, the rake angle could be reduced to 1 deg. and the face angle increased to 8 deg. without any material change. However, the angles given have proved successful when consideration is given finish and general cutting characteristics.

The angles given for soft or medium cast iron can also be used successfully for milling malleable iron. Aluminum and yellow brass require greater face angles. The average design for these materials would be a rake angle of 3 deg. and a face angle of 10 to 15 deg. The bottom clearance for brass should be approximately 4 or 5 deg., and for aluminum, 5 or 6 deg.

Since the introduction of tungsten carbide there have been many improvements in its manufacture so that it has become harder and tougher. The machining of steel, however, has not been entirely successful, due to the cratering action which exists when steel chips pass over the face of a T.C. tip. This is due to the strong affinity that tungsten has for steel. Much of this difficulty has been eliminated by the introduction of tantalum carbide, a product which has similar characteristics to tungsten carbide. Tantalum carbide does not have an affinity for steel, therefore the cratering action does not take place.

In this case, however, it happens that one advantage creates another problem. In so far as tantalum has no affinity for steel, the problem of brazing becomes more

difficult. With tungsten carbide, the bond between the tip and steel shank is greatly strengthened due to the affinity of the two metals. The reverse condition is true with tantalum carbide. Brazing problems have, however, been rather well overcome.

In connection with the milling of steel, tantalum carbide has proved satisfactory. From all tests that have been conducted to date, it appears that the increase in speed and feed over high-speed steel will be approximately 100 per cent. In other words, if a high-speed steel cutter is operating at 70 ft. per min. with a feed of 6 in., it is quite possible that tantalum carbide will run somewhere between 140 and 160 ft. per min. at a feed of 12 in. per min. An actual example of this contrast is obtained in the milling of forged steel gear blanks made of SAE 3140 steel, which require the removal of $\frac{1}{16}$ in. of material on each side. The steel is tough and hard and ordinarily is machined at 75 ft. per min. with a feed of $6\frac{1}{2}$ in. With a tantalum carbide cutter the speed has been increased to 170 ft. per min. and the feed to 14 in. per min.

In addition to what has already been said regarding the use and application of tungsten and tantalum carbides there are other factors which are necessary to consider in order that successful results will be obtained with either. Some of the most important are:

1. Carefully analyze every milling operation before applying these cutters. Do not try to mill all the difficult jobs at first. Begin by milling flat-faced surfaces where a uniform amount of material is to be removed.

2. Endeavor to make each milling application a success. Do not attempt to run the cutter too fast. Speeds and feeds are determined by the depth of cut, the amount of metal being removed, the type of material, its hardness, and the nature of the cut. Study all these factors carefully and, above all, do not attempt to exceed safe limitations.

3. Give operators full instructions before allowing them to use these cutters. They should be fully familiar with the characteristics of this metal. If not, take plenty of time to explain what it is, how it works, its advantages, and other information that is necessary for the assurance of success.

4. If the operation is a new setup, start slowly and carefully. Do not try to obtain maximum results on the first cut. Run the cutter somewhat slower and use less feed than you would ordinarily desire and expect. If all goes well, gradually increase the speed of the cutter slightly, then increase the feed gradually. This procedure is essential.

5. Do not disengage the spindle while the feed is engaged. If you wish to stop the machine, throw out the feed and let the cutter run for a few moments, then disengage the spindle clutch. If you stop the cutter while it is engaged in the cut, the sudden shock is likely to set up excessive strains, sometimes resulting in breakage of the inserts.

6. Do not try to set up an endurance record with these cutters. They should give longer life, but there is a limit. If the cutting edges appear to be slightly worn, hone them. It is sometimes possible to hone a cutter several times between grinds. When the cutting edges are slightly rounded over, it is time to sharpen the cutter. Regrind with care. Do not remove more than 0.001 in. of material at one time. Be sure that you are using a correct grade and style of wheel.

7. Be sure that you use a grinding machine that is in good condition. Accurate workmanship can only be attained by using accurate tools. Remember that it is as important to have the grinding machine in as good a condition as the milling machine.

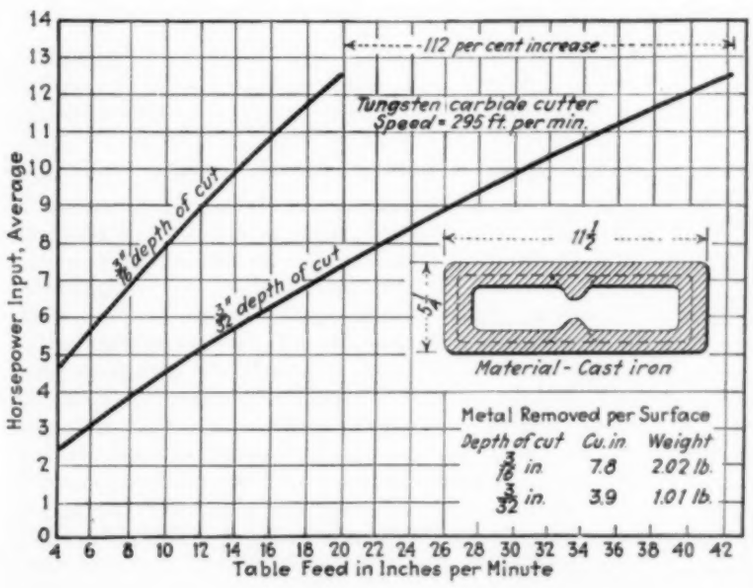
8. After a cutter has been reground, be sure to inspect it before placing it into service. If you do not have a suitable gage or fixture for this purpose, it will pay you to construct one. Use an amplifying type indicator so that a careful inspection can be made. The faces of the blades should be square within 0.0005 in., and the diameter should run within 0.002 inch.

9. These cutters are expensive. Handle them as carefully as you would a micrometer or other precision instrument. Do not allow a cutter to drop or to be knocked around carelessly. Provide a suitable storage space in your toolroom or crib for all these tools, and instruct your operators and tool crib attendants to handle them with care. Individual boxes are recommended.

10. Do not use a milling cutter for machining all kinds of materials. If you have a cutter suited for the milling of cast iron, do not attempt to mill steel with it. The results will be disappointing.

11. When increasing the speed and feed of a machine, there is a likelihood of overloading the motor. To be on the safe side, check the power input with an ammeter or wattmeter, or a proper recording instrument, to make sure that you are on the safe side. A motor may be overlooked for a short duration of time without any harmful effects; but, if the overloading is constant, there is danger of running into difficulties.

12. By following these instructions, it will be possible to obtain good results from these milling cutters. T.C. offers many economies, but like any other new development, it is quite necessary to know the requirements that make for success.


112 per cent increase
Tungsten carbide cutter
Speed = 295 ft. per min.
3/16" depth of cut
3/32" depth of cut
11 1/2
5 1/4
Material - Cast iron
Metal Removed per Surface
Depth of cut Cu. in. Weight
3/16 in. 7.8 2.02 lb.
3/32 in. 3.9 1.01 lb.
Horsepower Input, Average
Table Feed in Inches per Minute

Halving material removed from a piece results in three separate machining gains

NEW BOOKS

NON-METALLIC INCLUSIONS IN IRON AND STEEL—*By Dr. Carl Benedicks and Helge Löfquist of the Metallographiska Institutet, Stockholm, Sweden. 33 pages, 6 x 9½ in. Indexed. Clothboard covers. 139 illustrations. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price $8.00.*

The results of a study of slag inclusions in iron and steel, begun under a scholarship and finished under the sponsorship of the Swedish Ironmasters' Association, are presented in this volume. It is a comprehensive study of all phases of the problem, and as such should be of interest to the user of steels and to the metallurgist, as well as to the steelmaker, even though rather technical in nature and presentation. The seven parts of the book contain discussions of slag equilibrium diagrams and mode of occurrence, methods of qualitative and quantitative analysis of slag particles, factors influencing the formation and distribution of slag grains in a metal, influence exerted by slag grains on the properties of a material, comparison between slag contents of different kinds of steel, and possible means of reducing slag content. All literature published on the subject previous to 1928, and the best of that published since that time, has been critically examined and utilized. This aids the authoritativeness of the work, and brings it up to the moment in steel-making practice, but the continual reference to other works has the usual tendency to distract the reader.

A.I.E.E. YEARBOOK—1931. *614 pages, 6x9 in. Clothboard covers. Published by the American Institute of Electrical Engineers, 29 West 39th St., New York, N. Y.*

The primary purpose of this book, issued annually, is the publication of an alphabetical and geographical list of the membership of the Institute. A list of local sections and of institutions where student chapters are installed, is included. General information concerning the Institute, including its constitution, by-laws, and resolutions, is included, as is a report for the year.

BUSINESS ADRIFT—*By Wallace Brett Donham, Dean, Graduate School of Business Administration, Harvard University. 165 pages, 6x9 inches. Bound in cloth boards. Published by Whittlesey House, McGraw-Hill Book Company, Inc., New York City. Price $2.50.*

Here is one of the most thought-provoking books that has appeared in months. From its fascinating introductory essay on foresight, a philosophical treatment by Prof. Alfred N. Whitehead of Harvard, to the summary, in which Dean Donham admits that his logical analysis of the woes of business changed him from a "modified free trader" into an advocate of high tariffs where they are needed and a pleader for restraint in aggressive seeking for export trade, it is full of interest.

No review of this book could hope to bring out the points made by the author. One follows so logically after another that it is extremely difficult to break the chain and examine a single link. It may be remarked, however, that after defining the various factors involved in sound foresight or forecasting of events and the planning of appropriate action, he applies those principles to the chaotic situation in which we find ourselves, and suggests a plan by which we may make reasonably sure of our future prosperity. In doing so, Dean Donham draws a picture of present trials and possible future tribulations that sends cold shivers down your spine, no matter how stout-hearted you may be.

This book is not easy reading. Many a passage has to be read several times before one is sure that he has comprehended its full meaning. But the effort is worth while. If all business men, in whom our principal hope for the future lies, would study Dean Donham's analysis and practice his principles of foresight we should be far better insured than we now are.

THE STORY OF THE AIRSHIP (SIXTH EDITION)—*By Hugh Allen. 71 pages, 6x9 in. Indexed. Illustrated. Clothboard covers. Published by the Publications Department, The Goodyear Tire & Rubber Company, Inc., Akron, Ohio. Price $0.50.*

Published annually as a convenient reference book for students, writers, and others interested, this book represents the first attempt to cover the entire story of lighter-than-air craft in simple, non-technical language. It explains the different classes of airships, the part of the free balloon, military usefulness of the airship, effect of weather conditions, future plans for passenger Zeppelins, chronology of important airship flights, importance of helium and Duralumin, and offers fairly complete history of the building of the Goodyear Airship Dock and the new ZRS-4, named the "Akron." More than 100 photographs illustrate the book, chiefly of interest for the background and general understanding of this field it provides. There is little of technical value in the volume, but it provides a background and an explanation of many problems of airship construction in simple language for the lay reader.

WASTE MATERIALS DICTIONARY—*Prepared by the A.S.M.E. Elimination of Waste Committee. 54 pages, 5½x8¼ in. Paper covers. Published by the American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y. Price $0.50*

Waste materials and their reclaiming or disposal is becoming an increasingly important industrial problem. This dictionary of reclaimable materials was prepared from the practices of a number of leading companies in answer to a demand for concrete information on methods of identifying, collecting, sorting, and reworking or disposing of scrap and waste materials resulting from plant and office operation. Materials are classified in alphabetical order: a summary explains methods of collecting and preparing for disposal or reclaiming. The booklet provides a convenient means of ascertaining marketable sizes or forms of reclaimed materials, and should also offer ideas for profitable use of waste materials not now reclaimed by some companies.

Threading With a Hob

M. W. SEAVEY
Doheny Stone Drill Company

A THREAD-HOBBING machine should be built large and strong enough for rigidity. It should have bearings and spindles of adequate size and sufficient power to mill any work within its capacity. The hob itself is really a profile milling cutter, the teeth of which are normal to the axis of rotation and not arranged in a helix. The entire width of thread, as E in Fig. 2, is completed in one revolution of the work. In Fig. 2, C shows where the hob started and B the unfinished portion of the work. The arrows show the direction of the hob and the work which will produce a thread with a right-hand lead. While the work is making one revolution, the hob moves longitudinally a distance equal to the lead of the thread. Thread milling, both external and internal, straight and tapered, may be done close to shoulders on all kinds of metal. It produces close fits and an excellent finish.

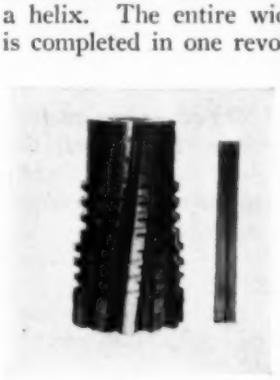


Fig. 1—This thread hob mills an internal thread for a flush pipe joint

Before setting up the machine, it is necessary to get the hob to be used and a sample or blueprint of the piece to be milled. Some figuring is required to select the proper gears for the hob and work speeds. It should be understood that correct operation requires the proper relation between the circumferential speed of the hob and the number of teeth to the circumference of the work. If the feed of the work is too slow, each tooth of the hob may not cut. The idle teeth become dull because they hit the work and then slide over it without cutting. If the feed of the work is increased to the point where each tooth takes a chip of the proper thickness, the life of the hob will be greatly increased and the finish of the work improved. One must also remember that every irregularity of either the hob or work helps to dull the hob teeth, especially if the material is hard and the feed slow.

The proper feed of work depends on the kind of thread, whether internal or external, or whether the thread form is free-cutting like a V, or a more difficult form to cut such as an Acme. The proper circumferential speed of the hob depends on the relation of its type and hardness (whether high-speed or carbon steel) to the kind of material to be milled. Aluminum, brass, carbon steel, nickel steel, nickel-chromium steel, and other materials will each require a different speed. The circumferential speed should be taken at the largest diameter of the hob as at A Fig. 3.

Let: D = largest outside diameter of the hob in inches
d = largest diameter of the work in inches
y = number of teeth in the hob
N = r.p.m. of the hob
N' = cutting speed of the hob in ft. per min.
n = speed of the work in r.p.m.
n' = minutes to make one revolution of the work.

Then the circumferential speed of the hob will be:

$$N' = \frac{D\,N}{12} \text{ ft. per min.}$$

The circumferential speed of the work will be:

$$\frac{D\,n}{12} \text{ ft. per min.}$$

or it will take $\frac{d\,n'}{12}$ min. to mill one foot.

The feed or chip per tooth of hob in thousandths of an inch will be:

$$\frac{d\,n}{N\,y} \quad \text{or} \quad \frac{d}{N\,y\,n'}$$

Referring to the table, it will be noticed that the speed of the hob in ft. per min. decreases as the tensile strength of the material increases and also that the chip per tooth of hob is less. The width of thread, E in Fig. 2, should not affect the chip per tooth, but the design of the hob affects it greatly. Considering hob design, if E were only a half inch long, a hob with teeth arranged parallel to the axis would be satisfactory. But what would happen if E were six inches long? As the hob teeth came in contact with the work, as at B, Fig. 3, the pressure built up between the hob and the work would have a tendency to push the end of the hob away from the work as at F, Fig. 4. This would allow only a small portion of the hob to cut on the length of the thread. Even when the gash is cut on a helix, one row of teeth generally leaves the work before another starts, for external work. See A and B, Fig. 4. This condition is one of the reasons slower speeds are required on external work.

The correct operation of a thread hobber requires an understanding of the fundamental principles involved. Here are some practical hints regarding set-up and machining

An ideal condition would be for all rows of teeth on the hob to run perfectly radial when mounted in the machine. This is rarely obtained, however, because in grinding the hob, a slight error may leave an error of 0.0005 to 0.001 in. on the face of the teeth. Other sources of error are the relation of the socket in the machine spindle to its bearing, the hob arbor,

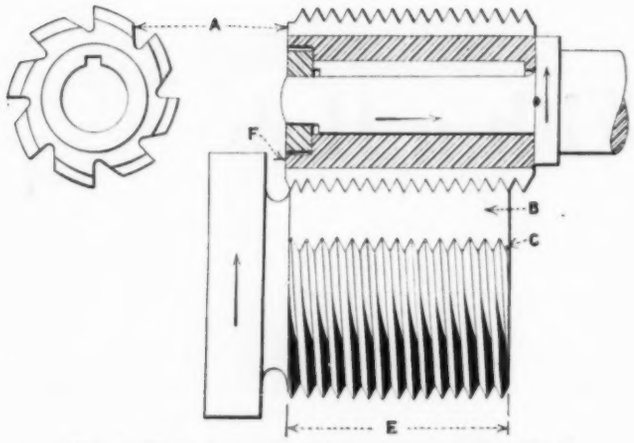


Fig. 2—The relative directions of the work and hob are shown for cutting a right-hand thread

and the sleeve when one is used. This accumulation of errors may be as much as 0.001 to 0.002 in. which would leave low and high sides of the teeth running from 0.002 to 0.004 in. eccentric. For example, assume that the teeth in the hob shown in Fig. 3 were each cutting 0.003 in. of chip thickness, and that there were eight rows of teeth. This would mean that from the time *B* in Fig. 3 made one revolution, the work would have advanced 0.024 in. Suppose *B* to be off center plus 0.002 for the reasons given. Then for every 0.024 in. there would be a deeper cut by 0.002 which would show up like ridges on external work. These marks are not chatter or feed marks but revolution marks caused by high rows of teeth. A rigid machine and careful tool set-up will avoid this.

It may be understood that the more nearly radial the rows of teeth run when the hob is mounted, the faster the feed may be. From the table it may be seen that the feed for external work is less than for internal work. Because of the greater angle of action of the teeth in internal milling and the nearly constant pressure between the hob and the work, these revolution marks do not show up. Consequently much faster feeds can be used. The number of rows of teeth have no bearing on how fast a hob may be run. The circumferential speed is determined by the diameter and the r.p.m. of the hob. However, the number of rows of teeth do greatly affect the milling time. As many rows as possible should be used in a given hob diameter. Of course, the section of the teeth must be left thick enough for regrinding, so economical production will result.

Sometimes in milling internal work of great length and small diameter (*E*, Fig. 2), requiring the use of a hob which is small in proportion to its length and contains a relatively large number of teeth, the hob has a tendency to push away from the work, especially at the end farthest from the support. This is partly caused by the greater angle of action as shown in Fig. 4, *DE*. The remedy for this is to increase the helical angle at the face of the teeth to the limit. If that does not overcome the trouble, do not put fewer teeth in the cutter, but make it of the alternate or interrupted tooth type. If fewer teeth are used in the hob, even if carried to the point where only one row cuts at a time, the trouble would not be corrected because that row would have to cut over its entire length. The pressure between the hob and the work would be built up and released before the next row of teeth started to cut, causing intermittent milling which is not desirable. It is better to leave all the rows of teeth and to make the hob of the alternate tooth type. Then each row would be cut only half its length and the pressure between the hob and the work would be far less. The following teeth would start to cut before the previous ones left the work thereby maintaining a more equal pressure, producing less vibration and smoother finish, and enabling the use of faster feeds. It is assumed that the hob teeth have the proper rake or undercut for the work being milled.

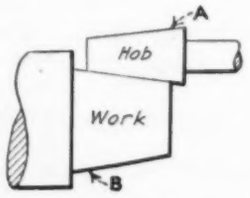


Fig. 3—In computing hob speeds the largest diameter must be considered

One may wonder why it is necessary to use speeds so much lower when cutting the harder metals. The feasibility of cutting at all depends upon the difference in hardness between the hob and the work. The hardest hob that can be produced without brittleness is necessary to mill the tougher metals. Such a hob would test about 85-87 on the scleroscope scale. A standard ratio between the hardness of the tool to the work is three to one. But there is another consideration—although an S.A.E. 1035 steel will show about the same hardness test as an S.A.E. 3135 steel, the former will be very free-cutting while the latter will have to be machined more slowly because of the toughness produced by the nickel content. Both steels will scleroscope close to 25, giving a ratio of 3.4 to 1. When steels harder than this are milled, with tensile strengths of over 92,000 lb. per in., the circumferential speed of the hob will have to be slowed down considerably. This should not affect the chip thickness per tooth, however. In fact, it is necessary to have each tooth take a full chip, because if one starts to slide over the work, the surface will become hardened and glazed rendering it more difficult for the following teeth to get a bite. In extreme conditions, it may be necessary to rotate the work and the hob in the same direction so each tooth will be sure to take a chip. The section of the chip would be the same thickness as the feed and would diminish to nothing, instead of starting at nothing and scraping over the work until the pressure between the hob and the work built up to a point where the tooth started to cut. When attempting to mill in this manner, one must be sure that the thread hobber is of such design that the work spindle cannot creep forward causing the hob to take too heavy a cut.

Fig. 5 shows the relation between work of different

Hob speeds and feeds in relation to tensile strength

Tensile Strength of Material Pounds Per Sq.In	External Thread Hob Speed F.P.M.	External Thread Chip Per Hob Tooth	Internal Thread Hob Speed F.P.M.	Internal Thread Chip Per Hob Tooth
60,000 } 70,000 }	100	0.003 to 0.005	85	0.006 to 0.010
71,000	95	0.003 to 0.005	80	0.006 to 0.010
80,000	82	0.003 to 0.005	72	0.006 to 0.010
81,000	80	0.003 to 0.005	70	0.006 to 0.010
92,000	60	0.003 to 0.005	52	0.006 to 0.010
93,000	59	0.003 to 0.005	50	0.006 to 0.010
112,000	40	0.003 to 0.005	40	0.006 to 0.010
114,000	39	0.0005 to 0.002	39	0.003 to 0.005
128,000	32	0.0005 to 0.002	32	0.003 to 0.005
130,000	30	0.0005 to 0.002	30	0.003 to 0.005
140,000	26	0.0005 to 0.002	26	0.003 to 0.005

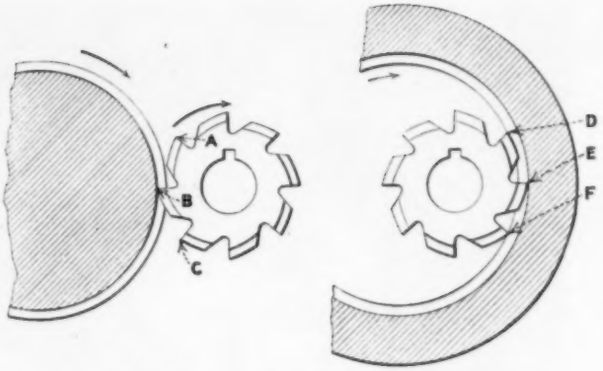


Fig. 4—A hob has a greater angle of action on internal work than on external, making faster feeds possible

diameters and time, with the cutting speed and feed constant. This does not take into consideration the time of bringing the hob up to the work and releasing it, but represents milling time only. The time for bringing up the hob may be added to the figures shown.

How may the efficiency of thread hobbing be determined? It would seem that the most efficient operation would be the maximum length of thread that can be milled in the shortest possible time before the ultimate deterioration of the hob. For example, the length of thread milled would be measured by the circumference in inches multiplied by the number of pieces milled and divided by twelve. This gives the number of feet milled. The degree of accuracy in computing costs may be carried as far as one likes but should include the following fundamentals:

$$\text{Cost of thread milled per foot} = \frac{(Y \times T) + D + E + F}{N}$$

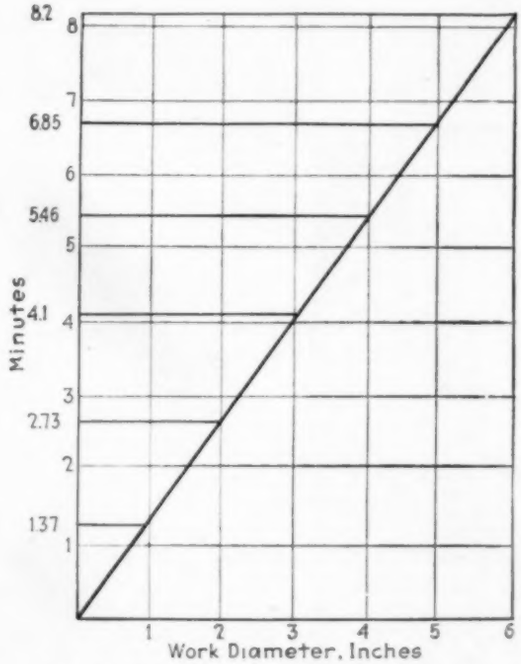


Fig. 5—The relation between work diameter and time to mill a given material. Hob diameter, 3 in.; hob r.p.m., 76.5; cutting speed, 60 ft. per min.; chip per tooth 0.003 in.; teeth in hob, 10

Where:

D = cost of the hob.
E = cost of the time to remove and insert a new hob (set-up time not included).
F = cost of all grinding time during the life of the hob.
N = total number of feet milled with the hob.
T = total time consumed in minutes to mill the given number of feet.
Y = machine cost per minute.

A hob, milling the same kind of material, using the same feeds and speeds but working on parts of two different diameters, will mill more of the smaller diameter pieces between grinds. But the total number of feet milled during the life of the hob should be the same for both sizes. So it is evident that the life of the hob cannot be measured by the total number of parts completed but by the total linear feet of the material milled. The cost of the hob and the number of grinds must be considered for the number of feet milled under any given conditions.

A good example of an application of this formula was on a job where steel of 92,000 lb. per sq.in. tensile strength was milled using 60 ft. per min. An oil salesman recommended a change in cutting oil and an increase in speed to 80 ft. per min. Since it is only by experiment we can hope to improve, this was tried. The machine was set to cut 80 ft. per min. and the feeds increased in proportion, keeping the chip per tooth the same. The result was that the work was satisfactory in quality of finish and did not seem to heat unduly under the faster speed. The job was run for six days under constant supervision. It was found that where previously 80 pieces were milled per grind now only 40 pieces were obtained. The salesman claimed that the loss sustained was more than made up by the time saved. But application of the above formula showed that the cost per foot of thread milled was increased by 5½ cents. The number of grinds in the life of the hob was not increased, but the number of pieces between grinds had decreased. Obviously the former milling conditions were more correct.

It often happens that machines are not run at their capacity because this is left to the machine operator. Machine operators are not as a rule schooled in figuring and often do not realize the feeds that may be used with multiple tooling. Hobs come under this classification. This article is written to show the foreman some of the reasons why close observation is necessary on semi-automatic machines such as thread hobbers.

■

IT has been found that Everdur may be welded by any ordinary welding method. The material is also readily weldable to steels, this property being utilized by steel furniture builders in spot-welding parts later to be enameled. The material makes a clean weld, without a flux. Westinghouse has been welding ⅛-in. Everdur to ⅜-in. steel by arc-welding to determine the feasibility of using it as a corrosion-resistant tank lining. Another company welded a broken cast-iron shear housing with Everdur and oxy-acetylene, achieved good penetration, and a weld machinable without difficulty. Various electric companies are using it to break magnetic circuits because of its non-magnetic qualities. To accomplish this, inserts of the material are welded into the steel.

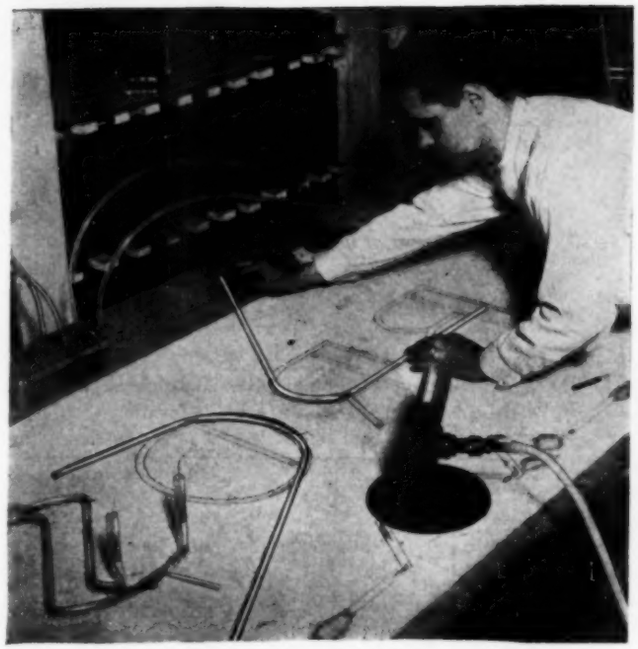
Will Neon Light Tomorrow's Shops?

Minor accidents in various factory areas as a result of inadequate illumination, constitute 15 per cent of all industrial accidents; they cost American industry more than a billion dollars annually. One way of reducing the total has been redesign of lighting installations; a suggested way involves the use of rare gases for lighting, the "neon tube" of commerce. In these pictures, the first released anywhere for publication, the steps in the process of making these lighting elements are shown.

Neon tube lights are the invention of Georges Claude, famous French scientist and engineer now engaged in extracting electrical power from the sea in Cuba. Some of the latest types of lamps are to be made with standard bases to fit ordinary sockets. The softness and economy of the lighting by this means have been major factors in its success. Here is shown the first stage in the process of making an ordinary neon tube advertising sign or decoration. The designs painted by this artist are next enlarged to the exact size of the desired sign

A giant clock and sign in Shanghai, China. Conservatively speaking, the current consumption of the neon tubes which light it is $\frac{1}{3}$ to $\frac{1}{10}$ that required by ordinary incandescent filament lighting. An a.c. potential of 8,000 volts is usually used, although it may be higher or lower. On d.c. current, a.c. converters must be used

After the design or lettering has been enlarged to the exact size of the desired sign, the design is transferred to thin sheet asbestos. Here a workman is going over the words that have been transferred from the original on the right. The words are printed backwards

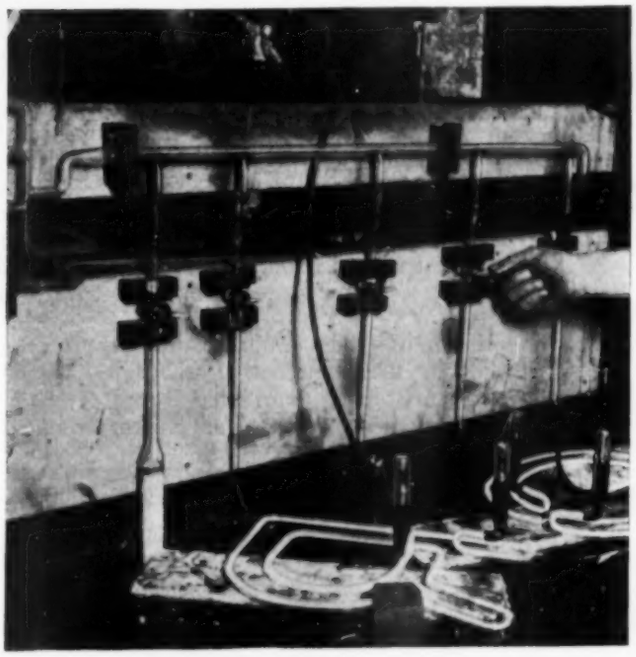


Left — Bending the tubing to correspond with the lettering on the sheet asbestos. This is accomplished by heating the glass over the gas burner shown until just before it reaches its melting point. It is then carefully bent in sections to fit the design

Photographs by Halbran

Right — Shaped tubing sections are fused with the aid of a special double blowtorch. As the heat melts the edges, the operator keeps blowing through the glass tubing by means of the rubber hose connected to its end. This exerts a certain air pressure within the tube and prevents joints from being clogged with melted glass

The completed tube is "bombarded" with a mercury vacuum pump. This is done to remove all air from the tube before it is filled with gas. During the bombarding process, 37,000 volts are sent through the tube, and though no gas has as yet been put within the tube, it glows brightly. This phenomenon is caused by burning of the impurities within the tube



After the bombardment, the same machine is used to pump gas into the tube. The general impression is that neon gas is used in all tubes, but this is not true. Five different colors are obtained, red, blue, green, yellow and white. Neon is the gas used in red lights only. Blue ones use mercury vapor and a combination of other gases. Green lights use the same gas as the blue ones, but amber colored glass tubing. Yellow signs are filled with helium and a combination of other gases, while the white ones are filled with special gases in a secret combination. This latter is the light to be used in factory and office lighting, hence the secrecy

Long and Short Addendum Gears

Discussion

H. T. MILLAR
Manchester, England

Further sidelights on a practical method for increasing gear tooth strength and the arc of contact of meshing gears

THE ARTICLE by A. B. Cox (*AM*—Vol. 74, page 197) does not mention one obvious factor governing this type of gear modification. If the gear tooth addendum is shortened by an amount equal to that added to the pinion, the degree of modification is limited by the number of teeth in the gear. Otherwise, the advantage gained in the pinion tooth is counteracted by a disadvantage in the gear tooth.

In any such system of modification, the amount of increase in the addendum of the pinion and the dedendum of the gear is dependent on the gear ratio and the pressure angle. In books on gearing dealing with addendum modification, charts show the amount of permissible modification for different numbers of teeth in the pinion and for different gear ratios and pressure angles.

In machine tools, it often occurs that pinions mesh with gears with an insufficient number of teeth to permit of much modification. It is quite practical, however, to run a pinion with a modified addendum with a gear cut with a standard addendum. Fig. 2 shows a modified pinion of 15 teeth meshing with a standard gear of 45 teeth. The pinion is cut on a blank turned to the standard diameter for 16 teeth. When two such gears are run together, the pressure angle and backlash are increased. The amount of change for either of these is not large.

Fig. 1 shows three modified pinions of 11, 13, and 15 teeth cut on blank diameters standard for 12, 14, and 16 teeth respectively. The advantages in tooth form are illustrated. While these pinions are used in mesh with each other, it may be noted that at standard center distances, the pressure angle is 26 deg. and the backlash about 1½ deg. of rotary motion. The arc of contact, even for these pinions, is slightly longer than one pitch.

This modification of addendum has advantages for internal gears where interference is marked. Fig. 3 shows a standard pinion of 15 teeth meshing with an internal gear of 150 teeth. The same ratio but with modified addendum is shown in Fig. 4.

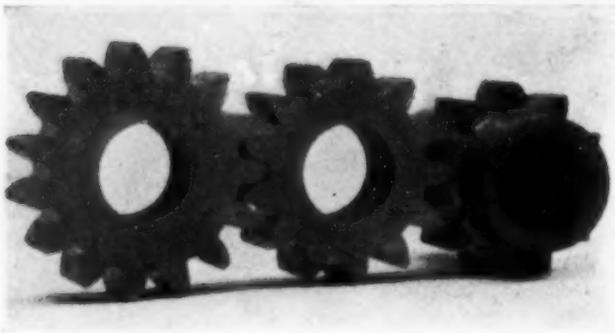


Fig. 1—Three long addendum pinions which show the advantages of modified tooth form

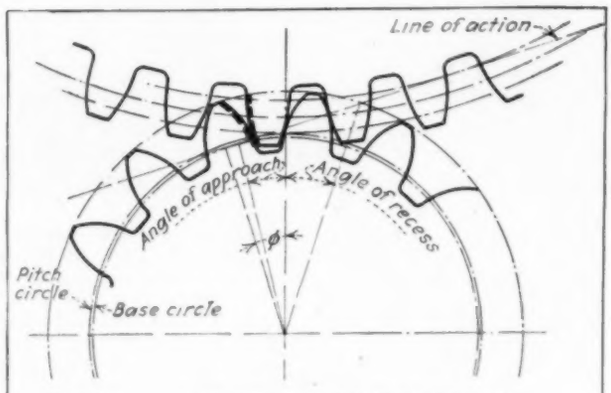


Fig. 2 — n = Number of teeth in pinion = 15
N = " " " " wheel = 45
ϕ = Pressure angle = 18°

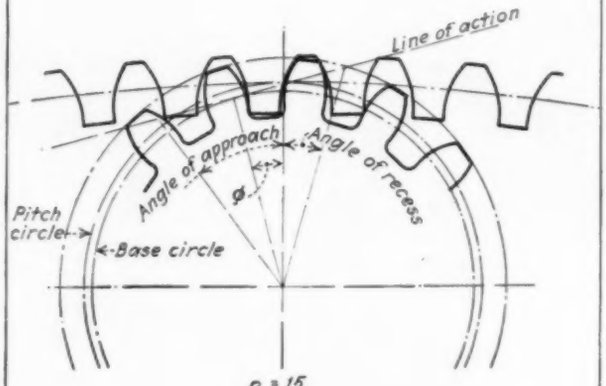


Fig. 3 — n = 15
N = 150
ϕ = 14.5°

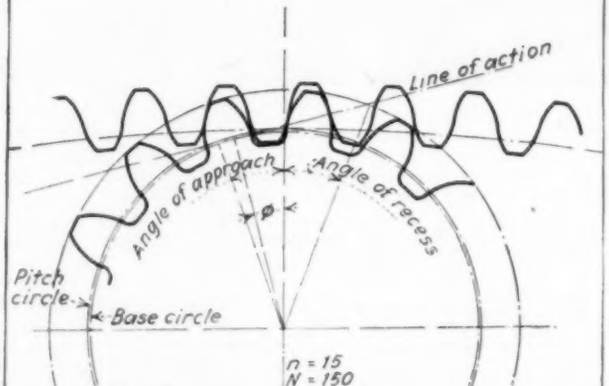


Fig. 4 — n = 15
N = 150
ϕ = 14.5°

Fig. 2—A modified 15-tooth pinion may be run with a 45-tooth standard gear. This design avoids the limitations of a short addendum gear. Fig. 3—Interference is common in internal gear sets where standard tooth forms are employed. Fig. 4—Long and short addendum gears avoid the disadvantages of the set shown in Fig. 3

IDEAS FROM PRACTICAL MEN

Making and Checking a Flat Square

JOHN J. MCHENRY

IN MAKING a device for generating parabolic curves of different focal lengths, it was necessary to make the flat square shown in Fig. 1. Even in the best equipped shops, making such a square is a fairly difficult job, and to our toolroom, making nothing but dies and special apparatus for automotive lighting, it proved interesting and in some respects rather novel. The essentials were a square of truly 90 deg., the outer edges to be hard. The square was forged from water-hardening steel, box annealed, machined to within $\frac{3}{64}$ in. of thickness, again box annealed, machined to within $\frac{1}{64}$ in. of thickness, and hardened.

Previous to hardening, the square was infolded in sheet metal $\frac{1}{32}$ in. thick, leaving the outer edges exposed to a width of $\frac{3}{16}$ in. Carbon steel will not harden in the section so covered, consequently when the square was quenched the edges were glass-hard to a depth of $\frac{3}{16}$ in., and the balance was soft. The warping due to hardening was easily straightened by peening, stretching the metal where required. To aid in seasoning and removing any hardening and peening strains, the square was plunged alternately in boiling water and ice water a dozen times, allowing it to remain in each of the waters long enough to reach their temperatures.

As to the grinding, I presume that the practice is much the same in any toolroom. We had the usual difficulty in keeping the square flat, and finally corrected it by a very slight peening, unnoticeable but effective. The method of checking and lapping may be of interest. Two parallels were laid on a surface plate, as per Fig. 2. The horizontal parallel was fixed and the perpendicular one was fixed during the testing operation. Placing the square against the horizontal parallel, alternately on each side of the perpendicular one, as shown by the dotted lines, and using a surface gage having a sensitive dial indicator attached, the checking was proof of the correct position of the perpendicular parallel, as well as a check of 90 deg. for the square. The perpendicular parallel was used as a base to slide the surface gage against, and so detect any errors in the set-up or in the square. For the sake of those who are sold on the use of a cylinder for checking a square, I will say that it is not a satisfactory method for checking a square of this size and thickness. The method of checking by parallels worked out nicely.

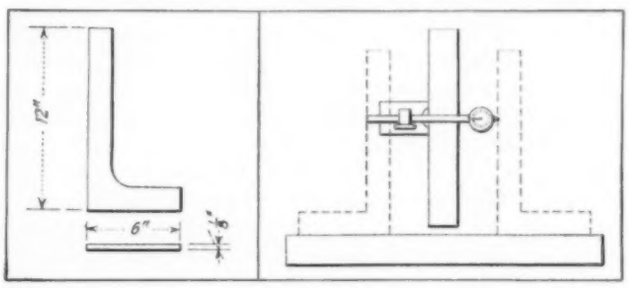


Fig. 1

Fig. 2

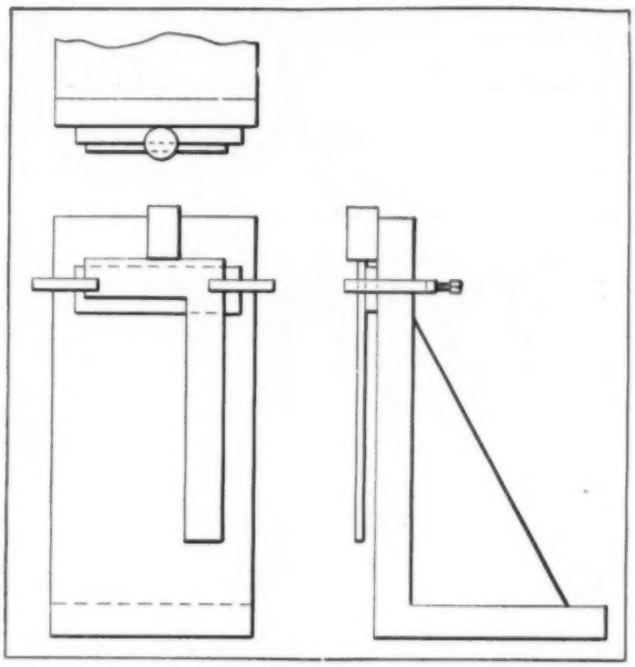


Fig. 3

In lapping the square, we fixed a piece of cold-rolled steel, $\frac{1}{2} \times 2 \times 12$ in., across the face of an angle plate, as shown in Fig. 3. Clamping the square against this piece brought it parallel with the face of the angle plate. The lap was a cylinder of cast iron, $1\frac{1}{8}$ in. in diameter and 2 in. long. Using the base of the cylinder for lapping, and keeping its side against the angle plate, insured that the lapped edge of the square would be at a right angle to its flat surface. The rest of the job was up to the workman's skill and ability, and in this case the result was highly satisfactory.

Cutting Quick Pitch Threads

A. W. DILTS

While I was master mechanic in charge of maintenance of a cement plant, the engineering department ordered ten or more conveyor screws for feeding the raw material into the roasting kilns. The screws, one of which is illustrated in Fig. 1, were 7 in. in diameter, had 3-in. lead and were to be cut from machine-steel forgings. The threads were $\frac{3}{8}$ in. thick and 2 in. deep. The only lathe available for the job was a 32-in. of the vintage of 1898. It was geared in the usual way to give a ratio of 12 to 1 between the lead screw and the spindle, the lead screw being $\frac{1}{4}$-in. pitch.

While we favored the lathe by taking light cuts, the first attempt to cut one of the screws resulted in wrecking the spindle gearing. We then decided to change the

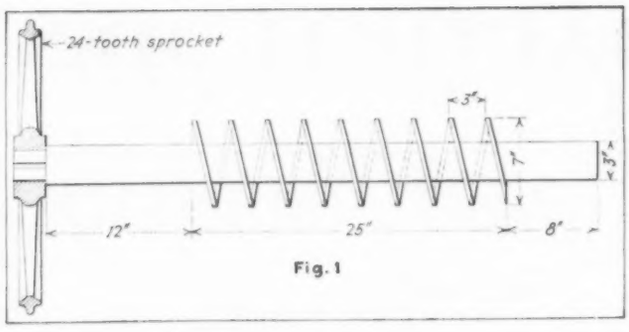


Fig. 1

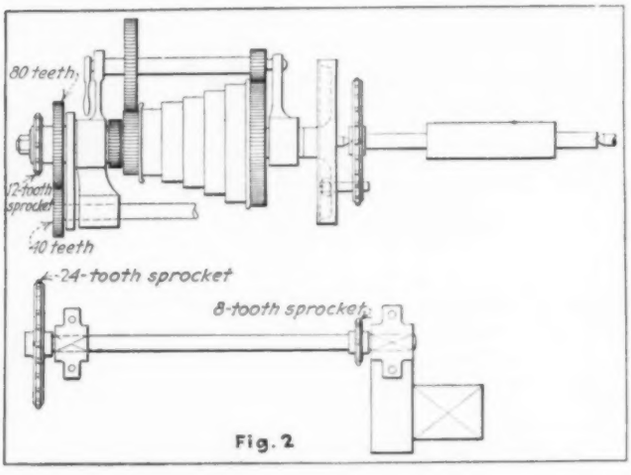


Fig. 2

drive. Having plenty of sprockets and chain in stock, we devised the method of driving shown in Fig. 2. A 24-tooth sprocket was keyed to the work and a 12-tooth sprocket was keyed to a quill on which was also keyed an 80-tooth change gear, the quill being mounted on the compounding stud on the quadrant. A countershaft was placed about 4 ft. in front of the lathe at about the height of the centers. One end of the countershaft was supported by one of the building columns, the other end being supported by a frame fastened to the floor and braced by a strut reaching to the lathe bed.

One end of the countershaft carried an 8-tooth sprocket, which was driven from the 24-tooth sprocket on the work. The 12-tooth sprocket on the quill was driven from a 24-tooth sprocket on the opposite end of the countershaft. Since the 80-tooth gear on the quill was in mesh, through an intermediate gear, with the 40-tooth gear on the lead screw, the result was a 12 to 1 ratio between the lead screw and the spindle. It will readily be seen that while the lead screw was driven by the lathe through the sprockets on the countershaft, there was no necessity for a large gear on the rear end of the spindle, which would have to carry the strain.

■

Boring in the Milling Machine, and Setting Tools for Precision Boring

Discussion

JOHN WINDON

The two articles under the titles given above, by Charles Kugler and Ernest Foldvary, respectively, on pages 22 and 26, Vol. 74, of the *American Machinist*, describe different methods for setting boring-bar cutters accurately. It would take either a courageous or a foolhardy man to set a cutter by either of these methods, providing he had to stake his reputation or his job on the results. Having had considerable experience in this particular field, I would like to offer a suggestion or two.

The method suggested by Mr. Kugler is against good practice, introducing, as it does, the following variables dependent entirely upon personal feel and judgment: (1) The first contact with the cutter point; (2) The first contact of the stop with the saddle; (3) The error of the screw; (4) The second contact with the cutter point; and, last but not least, the second contact of the stop with the saddle, which may not only affect the diameter of the hole, but also the true return of the work to its original exact location.

The method suggested by Mr. Foldvary presupposes an accurate surface on a true and true-running bar. Most of us who have had boring-bar experience, have yet to see such a bar in everyday use. With a bar ground to a uniform diameter, running on true centers, perhaps this method would be theoretically possible, though it is a tricky proposition at best. With a free running or an unsupported bar, it would be utterly impractical because the slightest run-out of the bar would throw everything out.

A simpler and much quicker method and one that is more certain as to results than either of the above methods, is to use a dial indicator, the support of which is clamped to the machine table or to the work. After a trial hole has been bored and measured, contact the cutting edge of the cutter with the button of the indicator by rotating the bar backward by hand. When the highest point of the cutter is in contact with the button, set the indicator dial to zero. Wipe the cutter past the button two or three times to check the zero setting.

The cutter can then be set out one-half the distance between the diameter of the trial hole and the required diameter of the finished hole, as shown by the indicator. This setting should be checked by two or three wiping contacts as described. You now have a setting that is accurate, but don't expect by this or any other method to move a cutter 0.006 in. and get a hole exactly 0.012 in. larger than before, unless you are on uncommonly good terms with Lady Luck. Incidentally, there are too many offset boring heads now on the market for any shop doing boring or tool work to waste much time on boring bars in which the cutters are held by setscrews.

I saw a boring head at the Power Show, recently, that would have made an old-time toolmaker's mouth water. It had a much larger range than usual, and as it was adjustable while rotating and while the tool was cutting, it would not only bore, but would also face, counterbore, recess, and so on, all at one set-up of the work, and all with nothing but a single-point tool. And to me, one of the nicest things about it was a big micrometer slip-ring, adjustable to zero like any feed-screw collar and graduated to half-thousandths, the graduations being, I should say, about $\frac{1}{8}$ in. apart.

With tools like this boring head, with modern universal angle-fixtures, and with gage blocks, sine bars and "tenth" micrometers in common use, the toolmaker of today ought to stop once in a while and take off his hat to the men of forty or fifty years ago who produced accurate work without these tools and without dozens of other conveniences that today are commonplace — though at a terrific cost if figured at today's prices.

Acme Taper Thread—*Discussion*

WM. S. ROWELL

The article by Frank A. Stanley, under the title given above (*AM*—Vol. 74, page 407) moves me to say that there are several details of threads on tapers that are not as well understood by all of us as might be. The accompanying sketches illustrate some of them. Perhaps some one who is long on "trig" will accurately figure it all out and give us the results.

A sectional Acme-threaded taper of 4 pitch, 8 deg. to center line, is shown in Fig. 1. It will be seen that cutting the thread normal to the center line would not cause interference. A taper of 8 deg. to the center line would use up a little more than half the standard 0.01-in. clearance. Of course, if the pitch were much coarser or the taper much faster, interference would take place. In such cases, the interfering corners could be reduced to provide clearance. The space between *c*, *c*, *c*, *c* represents normal clearance when the thread is normal to the center line, but because of the taper, this clearance is slightly enlarged on one side of the flat, as shown by *c*, *c'*, *c'*, and slightly reduced, as shown by *c*, *c'*, *c''* and *c'''*, *c''''*, and on the other side.

Outlines of 60-deg. threads, cut both normal to the center line and normal to the taper, are shown in Fig. 2. Taper *A* is the Briggs' standard of $\frac{3}{4}$ in. per ft. It will be seen that the difference between the two methods (less than 2 deg.) would be almost negligible, except in very coarse pitches. Even in threads as coarse as 4 pitch, U.S.S., the difference would be less than 0.006 in., which would not shorten the thread on one side or lengthen it on the other quite 0.0001 inch.

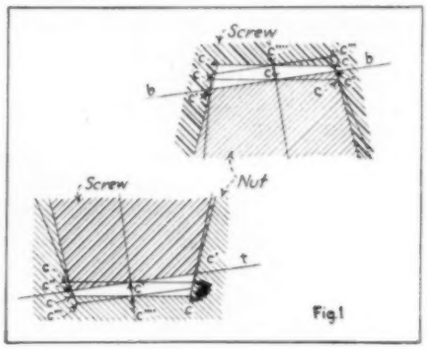


Fig. 1

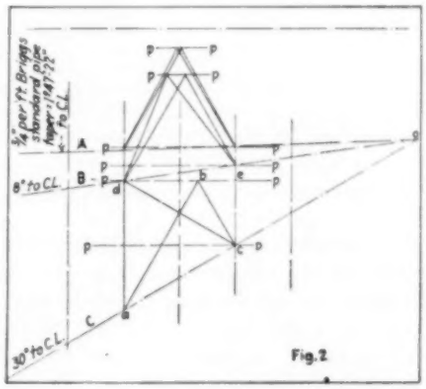


Fig. 2

Taper *B* represents the one described by Mr. Stanley, and is 8 deg. to the center line. In such a quick taper, there is quite a shift of position of thread, but the thread cut normal to the taper has no advantage in increased depth. In fact it loses because of the changed thrust angle, supposing that the tendency is to pull the nut off of the screw.

Taper *C* is 30 deg. to the center line. The thread section *a*, *b*, *c* is normal to the center line, while that represented by *a*, *d*, *c* is normal to the taper. Here again it will be seen by cutting the thread normal to the taper, nothing is gained in depth of thread, but the loss is heavy in the thrust angle. In such a thread, the pitch must be coarse and the fit good, or both the nut and the screw would tend to strip easily. The thrust angle *c*, *d*, *e* is only 30 deg., but the depth reduced is more than one-third the normal. My belief is that threads on tapers should be cut normal to the center line in almost all cases.

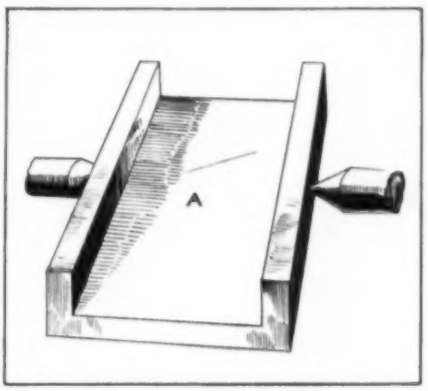
■

Filing Work Flat

MAURICE LAMBERT
Antwerp, Belgium

Every mechanic knows how difficult it is to file work that should be flat, without having it convex in the direction of the file. To overcome this difficulty, the device illustrated has given satisfactory service in my shop.

At *A* is a cast-iron plate having ledges at the sides and supported on centers, as shown, so that it can rotate freely. The work to be filed is secured to the plate, either by means of shellac or by lightly soldering it to one of the ledges. Since, during the filing operation, both the plate and the work will continuously follow the deviation of the file, the surface filed will be flat. The same procedure has been successfully applied to filing a notch across a round bar.



■

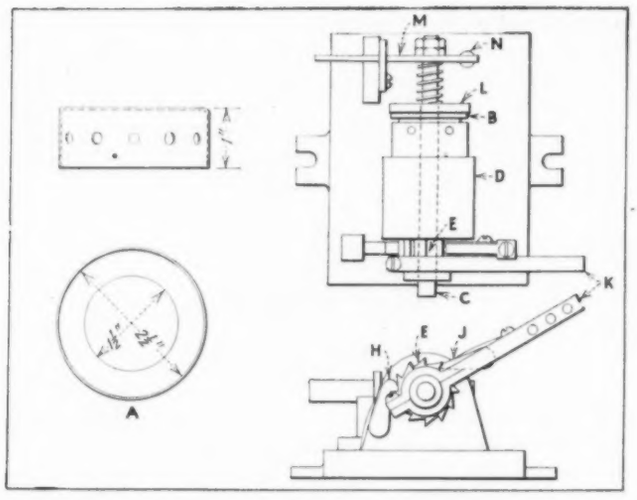
An Inexpensive Indexing Die

P. H. WHITE
Mechanical Engineer

The die shown in the illustration is for piercing twelve small holes in the sides of drawn-steel cups, one of which is shown at *A*. Two holes are pierced at a time, consequently their axes are parallel instead of radial. The difference is very slight and is entirely admissible in this particular part.

A cup is placed on the locating plug *B*, which is simply the head of the stem *C*. This stem is free to turn in the bearing block *D*. Keyed upon the outer end of the stem is the ratchet *E*, which is controlled in rotation by the two pawls *H* and *J*. Pawl *H* is mounted on the end of the bearing block, while pawl *J* is carried upon the operating lever *K*. Both pawls are held in contact with the ratchet by leaf springs. The operating lever is pivoted on a small collar attached to the stem by a set-screw, that end of the lever terminating in a split clamp provided with an adjusting screw.

The operating lever is oscillated by a rod attached to the ram of the press. Upon the upward stroke of the ram, the indexing takes place, the ratchet being rotated slightly more than one tooth. At the beginning



of the down stroke of the ram, the friction of the operating lever on the collar upon which it is pivoted, rotates the ratchet backward until arrested by the pawl *H*, thereby insuring correct indexing. Just back of the locating plug is the disk *L*, terminating in a screwed stem around which is a stiff compression spring. To the stem is attached the lever *M*, which in turn is pivoted at *N*. A latch locks the lever in place.

The two holes in the locating plug represent the piercing die. With the lever *M* released, the disk *L* is swung out of the way so that a cup can be placed on the locating plug. The lever is then brought back and locked in its fixed position. The pressure of the spring on the disk holds the cup firmly against the end of the locating plug so that it cannot slip in indexing, providing the die cuts clean and does not leave burrs on the inside of the cup. The operation is automatic and continuous.

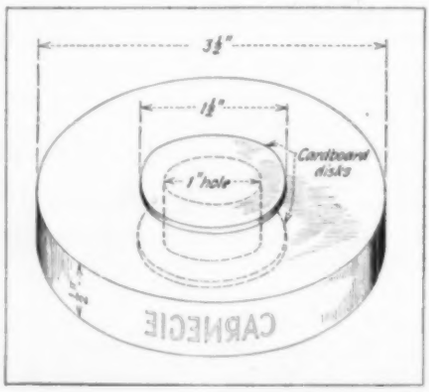
■

A Putting-On Tool

H. C. Rickenbach
President, Pittsburgh Stencil and Tool Company

Among our products are knurls for lettering on rolls, similar to the one shown in the illustration. The bores must be ground to accurate dimensions.

One of the knurls was bored $\frac{1}{64}$ in. too large. Since the customer was in a great hurry for it and could not wait for another to be made, we reduced the diameter of the hole in the following manner: Cardboard disks 2 in. larger in diameter than the hole were pasted on each side of the knurl, over the hole. The knurl was then put into a hydraulic press and a pressure of 100 tons per sq.in. was applied. The metal displaced by the pressure squeezed in the hole more than enough.



Checking Bushing Holes in Jigs
Discussion

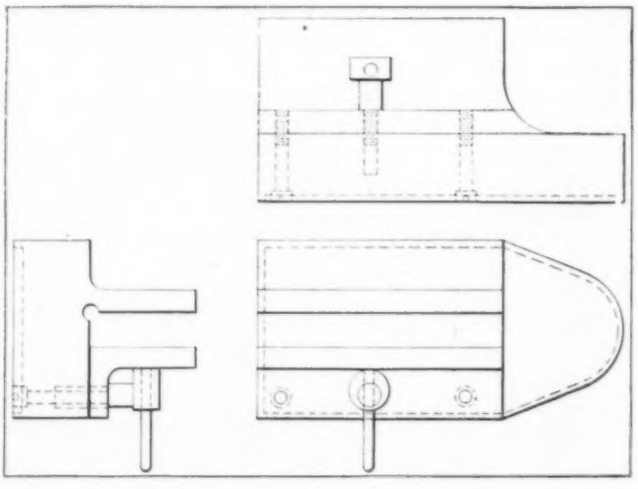
Charles Kugler

In reference to the article by George Belbes, under the title given above, on page 479, Vol. 74, of the *American Machinist*, I desire to say that the vernier caliper I used for the purpose had a beam 36 in. in length. Also that such a base as described by Mr. Belbes would not be accurate enough for so large a caliper, not even being hardened. It is necessary to take as much care in making the base as is taken in the making of the caliper itself.

I have a base in my tool kit that I made for use with a 6-in. vernier caliper many years ago. In fact I made two bases. The first one I had to scrap because I was unable to grind the slot accurately with the equipment at hand. For the benefit of those who have never made a base for converting the varnier caliper into a height gage, I will give my experience. The illustration shows how I consider that such a base should be made.

It should be made of tool steel, hardened all over and ground on the bottom. The top should be ground parallel with the bottom, and the upright should be ground accurately at 90 deg. therefrom. A sliding jaw, accurately ground, and an eccentric stud to clamp the jaw against the caliper, complete the device. I consider this method superior to the use of a screw.

Unless the base is accurately made, good results cannot



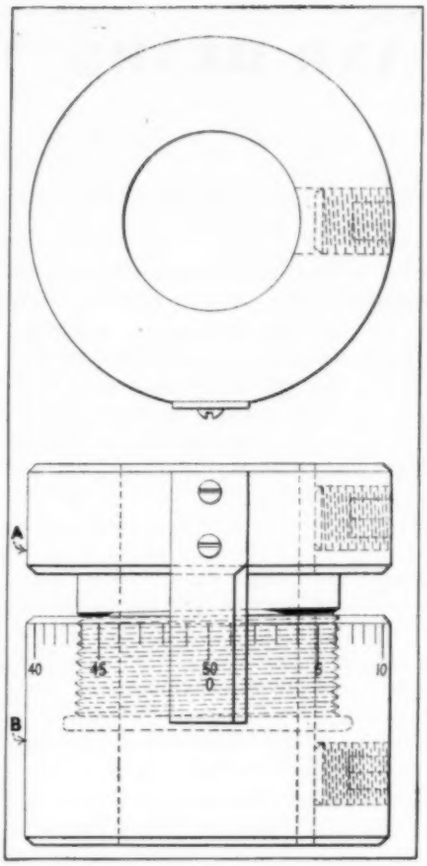
be expected from the use of the tool. One way to test the accuracy of the base is to use an indicator on the movable jaw of the caliper, and test the reading for each inch by gage blocks. If the stationary jaw of the caliper is not accurately square with the beam, it should be made so by grinding.

■

A Micrometer Stop for the Drill Press

A. J. Wormwood
Supervisor of Gages
Independent Pneumatic Tool Company

The micrometer stop shown in the illustration was designed to replace the usual drill-press stop, which requires a hammer blow for its uncertain adjustment. The parts *A* and *B* are screwed into one another and are



bored for a slip fit on the spindle. Part *B* is graduated in 50 divisions, and, since the threads are 20 per in., turning part *B* on part *A* one division makes a difference of 0.001 in. in their over-all height. An indicator attached to part *A* facilitates the reading.

In use, the stop is attached to the spindle by headless setscrews, being located either on the part of the spindle that projects above the spindle gear, or on the part above the quill, according to the construction of the machine. In the location first mentioned, the stop contacts with the web of the bevel gear, while in the second it contacts with the top of the arm on the sliding head. In placing the stop in the second location, it is necessary, of course, to remove the spindle. In this location, the sliding head must be so positioned that the quill is below the top of the arm. Brass pads under the setscrews protect the spindle from injury.

To set the stop, a trial cut is taken and the height of a faced boss, or the depth of a drilled hole, is measured. The difference between the measurement and the required dimension, expressed in thousandths, will give the number of divisions the part *B* must be moved. The setscrew in part *B* only is loosened in making the adjustment. If a reading as small as 0.0005 in. is required, the width of the indicator can be made equal to a given number of divisions plus one-half of a division, reading from one edge for thousandths and from the other edge for the half-thousandth. By the use of a stop of this type, a saving of more than 50 per cent has been made in the set-up time on multi-spindle drills.

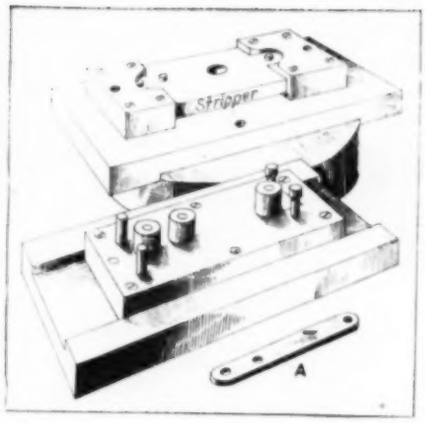
■

Efficient and Easily-Made Press Tools

CHARLES H. WILLEY
Superintendent of Manufacturing
Hoyt Electrical Instrument Works

A large quantity of parts, one of which is shown at *A*, was required to adapt one of our products to a new use. Instead of blanking the parts from sheets, they were made from $\frac{3}{64}$x$\frac{1}{2}$-in. bars of cold-rolled steel, sheared and pierced by the tools shown in the illustration.

The lower member of the tools consists of three dies, made from $\frac{1}{2}$-in. drill rod set into a steel plate and four guide pins. The two pins at the right also act as stop pins for the stock. All four pins are backed by springs and are depressed by the shearing dies in the upper member. A taper blade is provided to clear the trimmings.



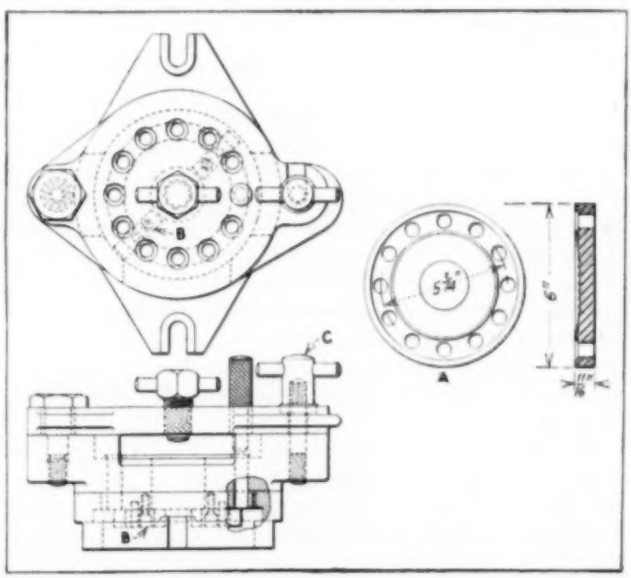
The upper member consists of three piercing punches, located in a plate; the two dies for shearing and trimming the ends; and a stripper having a center knockout pin. The shearing and trimming dies can be easily and quickly made in pairs in the milling machine. With this set of tools, the production was 2,000 pieces per hour, the feeding being done by hand.

■

Jig for Drilling Valve Covers

CHARLES C. TOMNEY
Chief Tool Designer, Brunswick-Krueschell Company

The jig illustrated was designed for drilling twelve equidistant holes in a circle in our valve covers, one of which is shown at *A*. Piloted in the base, the work-holding member is free to revolve, being prevented from lifting by the two gibs *B*. Clearance holes in the sides of the base provide means for the easy removal of chips. The bushing plate, which is also the cover, is pivoted on a shoulder screw at one side and is locked in position by a thumb nut at the opposite side. The work is located in a counterbore and is clamped by a thumb screw in the middle of the cover. To bring the bushing plate into alignment, the shoulder screw on which it is pivoted is a close fit in the plate, and the thumb nut fits closely into a counterbore.



If the jig is used in a multi-spindle drill in which the spindles cannot be set close enough together to drill all the holes at one time, they can be set for every other hole and the drilling can be done in two operations, rotating the work holder $1\frac{1}{2}$ revolution for the second operation. When the holes must be drilled in two operations, after the first series of holes has been drilled, a plug is put through one of the intermediate bushings and into one of the drilled holes. By this means, the work is both indexed and prevented from shifting.

■

Avoiding Trouble in Winding Springs

H. L. WHEELER
Tool Designer, Engineering Division, U. S. Hoffman Machinery Corporation

It is quite common to see mechanics who have not had much experience in winding coil springs make a mess of a roll of music wire when attempting to wind springs in a lathe. Occasionally one will suffer a severe hurt to the hands, and another will waste a great deal of wire before coiling a spring successfully. The trouble arises out of mishandling the wire on the roll.

Some men will pull out enough wire from the roll to make one or two springs without first cutting the binding wires that hold the wire in tension. As additional wire is used, the binding wires soon become loose and slip around. Others may cut all the binding wires but one, allowing the roll to spread out like a fan. If the roll is put back into stock, the next man who wants to use it generally finds a badly tangled roll of wire to work with. Sometimes it is so badly tangled that it is next to impossible to do anything with it.

Rather than waste time and patience with tangled wire, the roll is put back into stock and a new roll is taken out to go through the same treatment. A lot of wire then becomes just so much scrap. I have seen plenty of men who should know better, handle rolls of music wire in these careless and extravagant ways. To avoid trouble in handling rolls of music wire is a very simple procedure. It is essential to remember that a new roll of wire is under considerable tension, and it is this tension that causes most of the trouble and vexation. The first step then is to relieve the tension, which is a very simple matter.

After removing the paper wrapper, place the roll of wire on the floor and put a short piece of board over it. Place one foot firmly on the board to hold the roll down. With a wire cutter, proceed to cut the binding wires, and then release the pressure of the foot just enough to let the roll expand to the fullest extent. It will then be about twice the original diameter. Tie it in three or four places with soft iron wire or stout cord to hold it together. It will then be possible to reel off as much wire as needed for any job without further difficulty. Another method of doing the same thing is to place the roll between two short boards held in a bench vise, squeezing it between the boards when the binding wires are being cut.

By using either of these methods, a lot of time and grief will be saved for both yourself and the other fellow, also there will be less chance of the roll of wire flying out of the window, or getting caught around your collar button.

SEEN AND HEARD

●

"16 to 1"

THOSE MILD earth tremblings that have occurred recently in different parts of the country were undoubtedly caused by the old free silver advocates turning over in their graves. On or about the date they occurred, someone made up a set of three annular bearings for a 5-in. shaft and lined them with silver instead of babbitt. Whether this was done because the helper mistook one for the other is not of record, but the degradation of the peerless metal was complete on that day. And the earth from whence it came registered its protest.

As may be imagined, these large bearings of polished steel with a centrifugally cast liner of silver were a work of art. Gossip says that the three bearings cost $1,500, which goes to show that polished steel can be even more costly than solid silver. The advantage of a silver lining has long been sung in poetry and prose, but the specific advantages in the present case are better heat conductivity than babbitt and less wear than bronze. It is reported that one of the cars that we mechanics do not drive will come out soon with silver-lined crankshaft bearings. Heretofore, salesmen have had to appeal to our women folks on the basis of color and trimming. The power plant and coal bin under the hood have been kept hidden. But now, the salesman can proudly say "our engine troubles all have a silver lining."

Silver is not taking its humiliation lying down. It is reliably reported that it too is entering the "stainless" era and that soon we may expect to see knives on the market that will not be stained yellow by SO_2, while we are eating our ham and eggs.

Lubricating Presses and Planes

LUBRICATION problems come into play wherever two parts of any mechanism move or rub together. Two examples viewed the same day were especially interesting by contrast. One was a huge double-acting press which formed the side rails for the largest types of automobile frames. The other was the aileron and rudder bearings on an airplane. Both had fittings for lubrication with a pressure grease gun, in both cases representing improved practice, although it is more unusual on the plane than on the press. In both cases the practice makes for better and safer operation.

Foolish Figuring

THERE is another angle to the old adage "figures won't lie but liars will figure"—and that is the figuring of costs to four or even five decimal places. I recently saw a cost sheet which gave the cost of a certain piece as $00.05897. Aside from the wasted effort, not to mention the extra ink used, it is a lot safer to call the cost six cents and put the difference into surplus. Except for unusual instances, figuring costs to five decimal places sounds like accounting run mad.

Standard Gray Iron Sales Agreement and Trade Customs

Throughout industry, increasing numbers of trade associations and other groups are adopting definite sets of trade customs and standard sales agreements. One of the newer ones is the "Standard Sales Agreement and Trade Customs" developed by the Gray Iron Institute, Inc., and approved by the National Association of Purchasing Agents. They are here reproduced for their value to users and makers of gray iron castings and for those interested in developing similar sets of customs.

Standard Sales Agreement

All quotations are made and all casting are sold upon the following terms and conditions:

1. Unless otherwise agreed, quotations must be accepted and patterns furnished the foundry within thirty (30) days from date of quotation.

2. All castings are sold as rough castings, f.o.b. cars, foundry point. Terms—thirty (30) days net, from invoice date, unless otherwise stated.

3. Claims for error in weight or number must be made within ten (10) days after the receipt of castings.

4. Foundry is responsible for the replacement of castings rejected due to foundry defects, and such castings must be reported and returned to the foundry within ninety (90) days after their receipt. Foundry is not responsible for machine work, welding, labor charges or other losses or damages caused by defective castings unless otherwise agreed in writing.

5. Foundry is not responsible for loss or damage to patterns by fire or other casualities beyond its control.

6. Foundry shall not be liable in damages for failure to deliver as a result of fires, strikes, differences with employees, accidents or other causes beyond its control.

Trade Customs

Our purpose in setting forth these trade customs is to establish between customer and foundry a complete understanding of those conditions peculiar to the gray iron foundry business. They are not presented as a "Code of Ethics," for we believe general business ethics are so well established and understood that further elaboration is not necessary. Frequently, honest differences of opinion arise, and it is hoped that outlining the generally accepted customs will serve as a basis of settlement between customer and supplier in these cases.

Quotations

1. Blue prints submitted for estimating purposes should be marked with rough casting weight, if known, or an estimated weight upon which quotation will be based. A detailed description of the pattern equipment should be furnished.

2. When quotations involve the making of piece prices, definite weights shall be established and agreed upon, and quotations shall be subject to revision on any variation from the established weights.

3. Unless otherwise specified by the foundry, quotations are based on castings with gates, fins and other projections removed to approximately the contour of the pattern.

Orders

4. No order shall be changed unless notice of revision is made and accepted in writing before work is in process. If work is in process, customer is to be charged for any castings made as well as cost of cores, molds or equipment discarded because of such changes.

5. Cancellations of orders are to be made only by mutual consent of buyer and seller.

6. Unless otherwise stipulated, the customer shall accept an overrun of ten per cent above the quantities specified on order. However, the foundry is to make an effort at all times to furnish as near the exact quantity specified as operating conditions will permit.

7. If customer requires special production service to secure unusual deliveries, an extra charge shall be made.

Patterns and Core Box Equipment

8. Customer must supply equipment in condition to produce economically the quality and quantity of castings required.

9. An extra charge will be made if patterns require stopping off or if skeleton or sweep pattern equipment is furnished.

10. Foundry is not responsible for variations existing between blue prints and equipment supplied by customer.

11. All patterns, core boxes and loose pieces thereof should be marked properly for identification.

12. Follow boards, core driers and similar devices, when required, are to be furnished by customer.

13. Repairs and changes to patterns by customer's orders will be made at expense of customer.

14. All freight, drayage, boxing and crating charges on patterns, both to and from the foundry, shall be assumed by customer.

15. Pattern storage facilities are provided by foundry for active patterns only. Patterns not in use for a period of six (6) months will be returned to the owner or will be subject to storage charges.

•

To insure the elimination of error, the following recommendations, agreed to by other outstanding organizations of the foundry trade, are made:

Patterns are to be painted the following standard colors:

Unfinished surfaces—black.

Machined surfaces—red.

Seats of and for loose pieces—red stripes on yellow background.

Core prints and loose core print seats—yellow.

Stop-offs—diagonal black stripes on yellow base.

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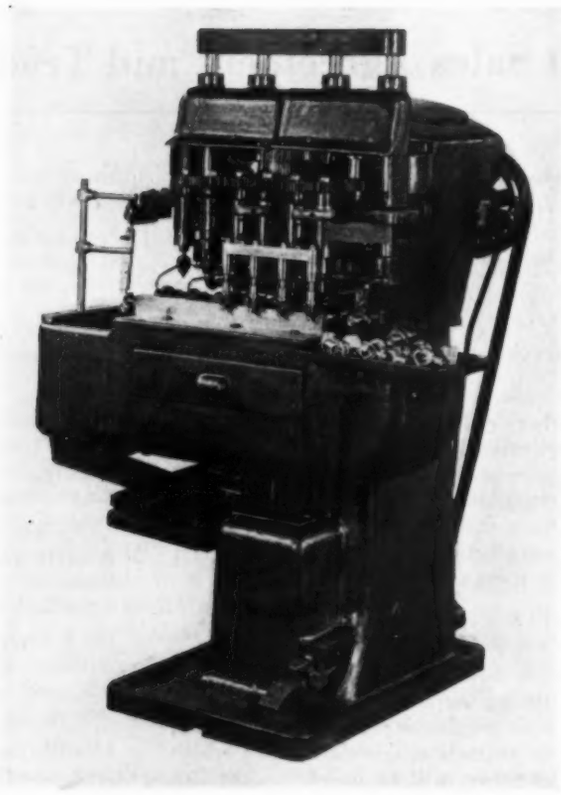


Globe Conveyor-Feed Drilling and Tapping Machine which accommodates pieces up to 6 in. wide by 14 in. long

Globe Conveyor-Feed Drilling and Tapping Machine

A combined drilling and tapping machine of the conveyor-feed type has been developed by the Globe Tapping Machine Company, 751 Central Avenue, Bridgeport, Conn. This machine can also be furnished with a dial or push feed table.

The unit illustrated is built for drilling four holes, using No. 36 drills, ¼ in. deep in the die casting and tapping two holes with Nos. 6-32 tap at a rate of 30 finished pieces per minute. The parts are loaded onto the fixtures and the ejecting is done automatically. The fixtures are mounted on the standard conveyor links made by the company and are made to index the parts 90 deg. when the conveyor itself is indexed. Through this arrangement holes can be drilled and tapped at any angle on the periphery of the part. The fixture shafts are arranged with sprockets and turn against stationary pins on the table. A spring plunger stops the fixtures at the desired angle, and the guide bushings for the drills are also arranged to clamp the parts when the drilling is performed.

Power for the spindle drive and index mechanism is furnished by a 1½-hp. 1,750-r.p.m. motor mounted on a tilting plate inside the base. From the motor the drive is transmitted through a belt to the clutch at the rear. The clutch is operated by means of a treadle. One spindle slide is equipped with drilling spindles and the other with tapping spindles, permitting the maximum allowable time for drilling. For drilling, a long lead and quick rise are employed, working entirely independent from the slide with the tapping spindles. All spindles are adjustable and driven positively through spur gears.

The conveyor feed table is also employed on the company's regular tapping machine as well as on the combined drilling and tapping machine or drilling machine only. For small lots of parts of different sizes, this type of conveyor can be arranged with the same fixture and adjustable rails to permit its use without extra fixture expense.

The straight-motion feed permits taking parts up to 6 in. wide and about 14 in. long. Since the parts are moved by the machine and the spindles can be set independently, the holes can be drilled and tapped as close together on this unit as on a single spindle machine and without sacrificing the rigid spindle construction. One part is finished for each stroke of the machine.

Kramer Circular Production Estimator

A production calculator has been announced by C. P. Kramer, 4554 West Congress St., Chicago, Ill., for use in figuring drilling, turning, forming and cutting-off operations carried out on turret lathes and single- or multiple-spindle automatic screw machines and chucking machines. This instrument is of pocket size, circular in shape, and is made of stiff sheet brass with etched figures and divisions. One half of the circumference of the larger dial, which is 4 in. in diameter, carries a scale of spindle speeds, ranging from 35 to 3,500 r.p.m. The other half carries a scale of elapsed time, ranging from 2 sec. to 3.5 min. The smaller dial, rotating on the larger one, carries on the upper half of its circumference a scale of feeds in thousandths of an inch per revolution, and on its lower half a scale of lengths or depths of cuts in inches. If a selected feed be set to the desired spindle speed, cutting time appears opposite the division corresponding to the length or depth of cut. Production per hour of

EQUIPMENT NEWS

parts requiring from 1 sec. to 3.5 min. apiece, can be read from scales on the face of the large dial, through the oblong windows in the small one.

Conversely, feed per revolution can readily be determined for any given length or depth of cut and given spindle speed. The effect upon elapsed time of an increase in feed per revolution can also be determined. Thus the device is useful for checking up on existing jobs, as well as laying out new ones.

The calculator is furnished, together with complete instructions, in a flexible case.

Kane & Roach 11-Stand Cold-Roll Forming Machine

Among the developments of machines for cold-roll forming is that by Kane & Roach, Inc., Syracuse, N. Y., of a machine to manufacture a patented retainer strip for gypsum board. When such board is used in place of wood or metal lathe in building construction, the retainer strips are fastened to wood studdings by nailing through the center groove and to steel stud channels by means of clips on the solid back flanges.

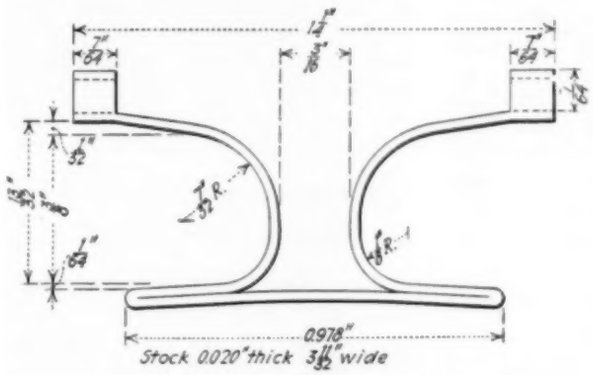


Fig. 1—Cross-section of retainer strip manufactured in lengths up to 12 ft. or longer

Fig. 1 is a cross-section of this retainer strip, which was formed both from planished stock and black-finished strips $3\frac{1}{32}$ in. wide by 0.020 in. thick, in lengths up to 12 ft. The machine also takes coil stock for forming into long lengths cut to size afterward on a cut-off machine.

The main frame of the machine, as shown by Fig. 2, is made long enough to take eleven stands, although only nine are required for this particular job. The machine is of standard construction, having $1\frac{1}{2}$-in. shafts, $4\frac{1}{8}$-in. rolls on 8″ in. center distance, and a roll space on the shaft of 6 in. Outer bearings of the quickly removable type are mounted on the guide support platform.

In order that the scalloped edge be of uniform width, the width of the blank stock must be held to within close limits and must be without camber. These requirements necessitate almost a micrometric adjustment of the starting guides to align stock with the first set of rolls. Shearing and forming of the scalloped edge is done simultaneously in the ninth set of rolls by the use of special forming rolls. The forming rolls have the shearing edges designed to allow grinding the faces and being returned to the proper position.

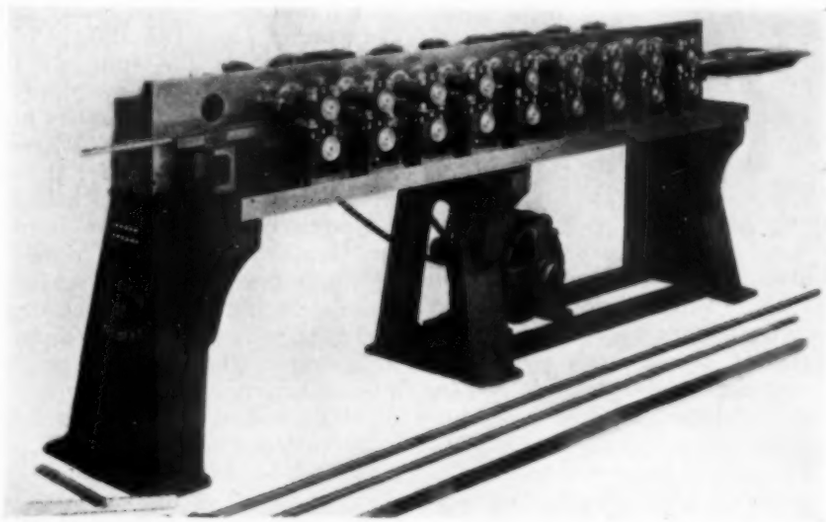
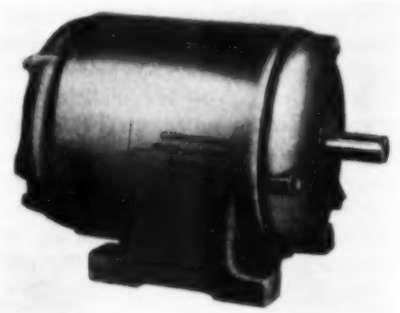


Fig. 2—Kane & Roach Cold-Roll Forming Machine having nine stands set up for cold-roll forming of a retainer strip for gypsum board. Shearing and forming of the scalloped edge of the strip is done in the ninth set of rolls

Rite-Lo-Speed Ball Bearing Motor

J. D. Christian-Engineers, 512 Brannan St., San Francisco, Calif., has developed a "Rite-Lo-Speed" motor that embodies a standard footless stator and rotor and heat-treated alloy steel helical gears. These gears are ball bearing mounted so that the entire assembly is scarcely larger than the motor itself. The gear end of the assembly, or speed reducer end, embodies only two gears and two pinions. It is so arranged that a heavy overhung pull can be taken on the final shaft without the use of an outboard bearing. The oiling case is sealed from the motor and the entire assembly is protected by a dirt-proof and water-proof housing.

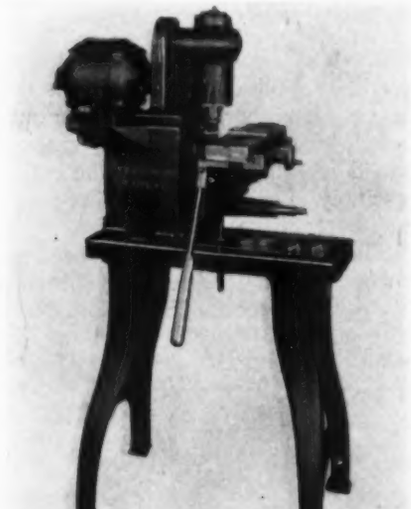


The Rite-Lo-Speed motor-speed reducer is manufactured in four series. Series A is standard, comprising the

motor and housing with a single power take-off. Series B is a single motor unit with a gear housing at each end thus having two power take-offs at the same speed. Series C is the same as Series B with the exception that it has two power take-offs at different speeds. Series D is a single motor unit with a gear housing at one end with power take-off at reduced speed, and with high-speed motor shaft extended through the rear end bell. The motor is made in sizes from 1 to 30 hp., and a junior model is made in sizes from $\frac{1}{4}$ to 1 horsepower.

Stevens Motor-Driven Vertical-Spindle Screw-Head Slotter

For milling slots in the heads of long screws, and also for milling across the ends of pieces too long to be held vertically on the machine table, a vertical-spindle screw-head slotter has been developed by the John B. Stevens, Inc., 304 Hudson St., New York, N. Y. The bodies of the screws or other pieces are held in the V-jaws of a combination table and vise. In operation, the operator keeps his left hand on the table lever and his right hand is used in placing and removing the work. When the table



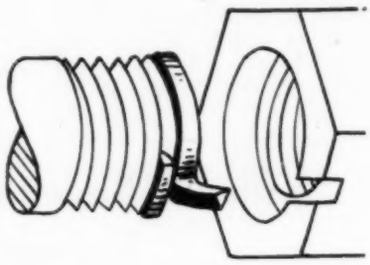
is moved to the left and away from the cutter, the work-holding jaws open, permitting the removal and replacement of the work piece. On moving the table to the right and toward the cutter, the vise jaws close automatically.

The knee of this screw-head slotter is provided with vertical adjustment for centralizing work with cutters of various widths, and the knee can be lowered for removing the cutter arbor from the spindle. All rotating parts of the machine revolve in large ball bearings. A $\frac{3}{4}$-hp. constant-speed motor running at 1,140 r.p.m. is employed. This motor, with the four removable gears supplied, provides spindle speeds of 85, 142 and 237 r.p.m., or 61, 102 and 170 cutting feet per min. for $2\frac{3}{4}$-in. diameter saws. Three sizes of vise jaws furnished will grip the screw or bolt body from $\frac{3}{16}$ to $\frac{5}{8}$ in. in diameter. Screws up to 5 ft. in length can be handled on the machine.

Specifications: Taper hole in spindle, B&S No. 7; maximum diameter of saw, $2\frac{3}{4}$ in.; maximum width of saw, $\frac{3}{16}$ in.; maximum screw head diameter, 1 in.; maximum screw body diameter, $\frac{5}{8}$ in.; weight of machine, crated, 690 lb.

"Safety Nut" Brake Lock Nut

Another type of safety nut has been introduced by the Safety Nut Corporation, Land Title Bldg., Philadelphia, Pa., in the form of the "brake lock" nut. This complements the line of "pin-nut" type safety nuts developed some months ago. Whereas the pin-nut type is made for the insertion of a formed pin to hold the nut precisely at the location desired, the "brake lock" type is provided with a formed brake lock band that permits the nut to be screwed down easily but resists backing off through the action of vibration. The nut has a small aperture at the bottom, in which the end of the brake lock band is inserted and held. As shown, the brake lock band is lying expanded on the first thread of the bolt with the handle raised to meet the descending groove or aperture provided in the nut. Once the handle is seated in the groove, the brake lock band will not slip from position when applying or removing the nut. As soon as the nut is given the slightest turn on the bolt thread, the brake lock band, cocked in an expanded position, slips



Spring steel brake lock band on screw ready for engagement with the Brake Lock Nut

and commences a spiral descent, while firmly hugging the sides of the thread. Just so long as the nut is advanced, there is no resistance, but when an effort is made to withdraw the nut the expanding brake lock band of spring steel sets up a resistance which requires a wrench to overcome.

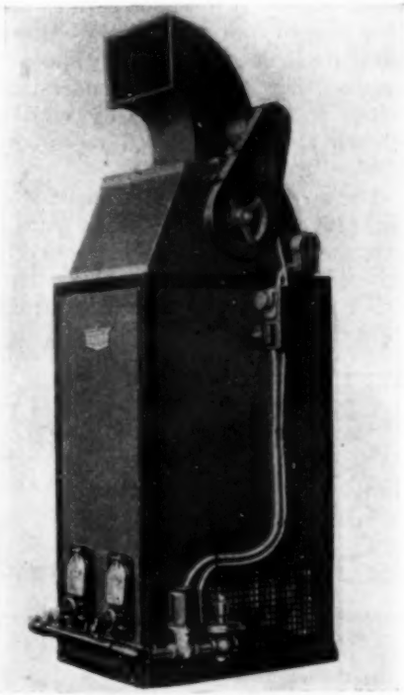
Paasche Clamp-Tight Pressure-Feed Tanks

A pressure-feed tank for use with paint spray guns has been announced by the Paasche Airbrush Company, 1909-27 Diversey Parkway, Chicago, Ill. This tank saves time in use and is airtight at a pressure of 100 lb. per sq.in. The cover can be put on or removed in 15 seconds by turning the eccentric. Air pressure is controlled by the regulator and gage. The tank

is made from pressed steel and is lead-coated to prevent corrosion. It is available in capacities from 3 to 60 gal., and may be had with wheels and a handle assembly. Motor agitators and electric heaters are optional equipment.

Reznor Type V Gas-Fired, Warm-Air, Forced-Circulation Heater

The type V gas-fired, warm-air, forced-circulation heater for factories and shops, announced by the Reznor Manufacturing Company, Mercer, Pa., combines complete heating equipment in one unit and occupies little floor space. It may be used singly or in multiple for automatic heating of factory interiors and does away with the necessity for a central boiler plant. It consists essentially of two, four, six or eight combustion and heat transfer units in which the gas is burned. Each combustion unit is of grey cast iron containing the burner at the bottom, a vent chamber at the top, and sixteen interconnecting vertical triangular flues. The burner is also of grey cast iron and the mixer tube is of Venturi design. The bunsen-type pilot will not blow out.



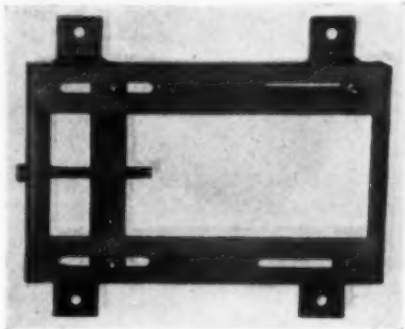
Sheet steel panels are used for the casing and are fastened securely by drive screws to the heavy angle frame. Mounted above the heater are one or more standard squirrel cage fans on a shaft mounted in ball bearings. A fan and discharge hood are provided for each pair of combustion units. Each fan is statically and dynamically balanced and operates at low speed and gives noiseless operation. Automatic control devices minimize the supervision required. Four sizes are manufactured, to deliver 100,000 to 400,000 B.T.U.

Bunting Hard-Bronze Bearings

Bushings and bearings made of a hard low-friction, phosphor-bronze alloy are announced by The Bunting Brass & Bronze Company, Toledo, Ohio. These products are offered for applications where hardness and ability to withstand pounding are particularly essential, together with the low friction and minimum wear assured by a leaded phosphor-bronze alloy. The lead content may vary from 5 to 25 per cent, depending upon the type of service required.

Lincoln Welded Steel Motor Base

A welded steel motor base of one-piece construction has been placed on the market by The Lincoln Electric Company, 12818 Coit Rd., Cleveland, Ohio. This base is designed to be used instead of slide rails. It is constructed of rolled steel angles and flat bar stock fabricated by means of the electric arc. The flanges of the angles to which the motor is bolted are slotted to permit moving the motor on the base for the purpose of tightening the drive belt. At one end a screw adjustment is provided. Drilled angles are-welded to the sides form hold-down lugs for securing the base in position.



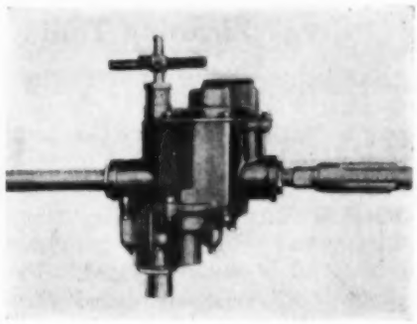
"Berg" Cleaning Tool

For the removal of paint, rust and scale from steel surfaces, the Concrete Surfacing Machinery Company, Berg Cleaning Tool Division, 4667-69 Spring Grove Avenue, Cincinnati, Ohio, is introducing the "Berg" cleaning tool. The device is light in weight and is easily operated. Two cutter bundles—24 hardened steel, 14-pointed cutters in each bundle—are mounted one on each side of a gear housing. This set of cutter bundles, totaling 48 cutters, revolves at 2,000 r.p.m., causing the cutters to be thrown outward by centrifugal force and to strike the surface 96,000 times per minute. This action cleans the surface without injury. The depth of the cutter contact is regulated by an adjusted depth shoe. The surfaces are thus quickly restored to a bright, clean, smooth finish, making possible proper adhesion of new paint.

"C-P" No. 99-C Rotary Drill

The "C-P" No. 99-C pneumatic rotary drill, announced by the Chicago Pneumatic Tool Company, 6 East 44th St., New York, N. Y., employs no pistons, toggles or crankshaft. It is adapted to general-purpose drilling and reaming, particularly in close quarters. The balance of the drill assures smooth operation. Ball or roller bearings are used throughout, and complete lubrication for the

motor is effected by a line oiler located in the housing. Adjustable grease fittings are placed on the gear and governor cases. For strength and ease of repairs, through-bolt construction is employed. The governor control on the intake air supply maintains free speed, as well as reducing air consumption.



"C-P" No. 99-C Rotary Drill

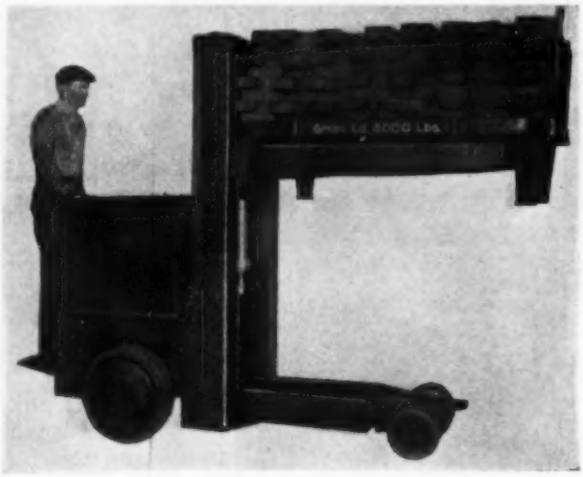
The No. 99-C rotary drill has capacity for drilling 1½ in. holes and reaming 1⅛-in. holes. The light speed is 300 r.p.m.; length over-all, 14¾ in., the spindle offset, 2 1/16 in.; the length of feed, 4½ in., and the net weight, 35 lb.

Mercury Type EL Lift Trucks

Two types of lift trucks, both having approximately the same general dimensions and capacity of 6,000 lb., the one capable of raising the platform to 62¼ in. and the other to 23 in. above the floor, have been announced by the Mercury Manufacturing Company, 4118 S. Halsted St., Chicago, Ill. The outstanding feature is the application of a hydraulic hoist for platform elevation, consisting essentially of a hydraulic ram working through cables and sheaves and actuated by a motor-driven pump. Raising is accomplished by push-button control of the separate, series-wound driving motor. Lowering is accomplished by means of a throttle valve interlocked with the push-button for the motor, so that the hoist motor cannot operate during lowering. A limit switch prevents overtravel of the platform, and a simple relief valve prevents overloading the hydraulic system.

For the main truck drive the motor and drive axle assembly are all in one unit, the motor housing being mounted directly upon the axle housing. Drive from the motor is through a spiral bevel gear set and a pair of spur gears, all mounted on ball bearings and operating in an oil bath.

By making the battery compartment entirely free from overhead obstruction, the batteries are easily removable from either the sides or the top. This construction permits the use of the new high-type cells or a gas-electric unit. Fully loaded, the truck will travel 4 to 4½ miles per hour, and light, 6 to 7 miles per hour.

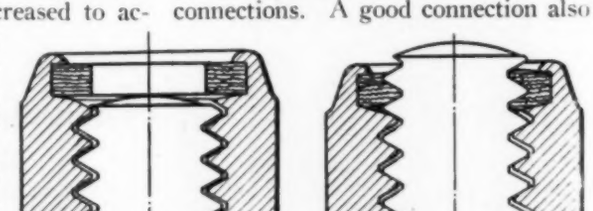


"Elastic" Stop Nuts

The Elastic stop nut has the same capacity as any standard nut. It differs from a standard nut only in that the height has been increased to accommodate the fiber ring employed to prevent backing off through vibration. The height corresponds approximately to the height of a standard nut plus the thickness of a lock-washer. The threads are standard with respect to height, form, pitch, and fit and are produced in any system.

As shown by the accompanying illustration, the hole in the fiber ring is smaller than the diameter of the bolt. Therefore, the ring resists passage of the bolt and causes the thread flanks of the bolt and nut to be pressed tightly together. This pressure occurs on the underside of the bolt threads; the same side that carries the load. Thus, all play between the bolt and the nut is removed. When the pressure of the bolt on the fiber ring exceeds the maximum, the bolt impresses its threads on the fiber ring but does not cut out chips. Considerable friction is developed and is further increased when the bolt is drawn home. The extra friction developed prevents any tendency for vibration to loosen the nut. The elastic nature of the fiber permits the fiber ring to contract and move down when the bolt is removed. The nut locks on new, worn, and undersized bolts. It is removed easily with a wrench and can be used repeatedly without damage.

The air-tight fit of the Elastic stop nut prevents moisture from getting past the fiber ring, and consequently this feature, besides the vibration-proof feature, is of value in electrical connections. A good connection also results from the pressure on the thread flanks. The device can also be employed on spring mountings, rubber insulated and cushion mountings, aircraft propeller shafts, and flexible couplings, to mention a few where vibration is particularly severe.

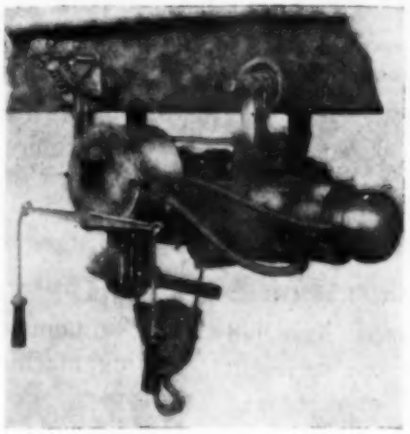


Left—Bolt at the point of entering the fiber ring. Right—Showing how the fiber ring is pushed upward and thread impressed in it besides pressing the thread flanks together

The Elastic stop nut is manufactured by the A. G. A. Company, Elizabeth, N. J., in sizes from No. 4-48 up to 2½ in., in such materials as steel, duralumin, brass, bronze, Monel metal, and other metals. It is made in any standard thread system and is capable of repeated removal without injury to itself or the threads of the bolt. Furthermore, it is adjustable to any position along the screw.

Sprague ¼- and ½-Ton Electric Hoists

The Sprague Electric Hoist Division of the Shepard-Niles Crane & Hoist Corporation, Montour Falls, N. Y., has announced a¼- and a ½-ton electric hoist employing a ball-bearing General Electric motor. This hoist features compactness, close headroom, and a simple worm drive. Wiring is entirely inclosed in conduit. The control may be either by a pendant rope as shown, or by means of a push-button control. Since the hoist is entirely inclosed both mechanically and electrically, it may be used both indoors and outdoors. The trolley is

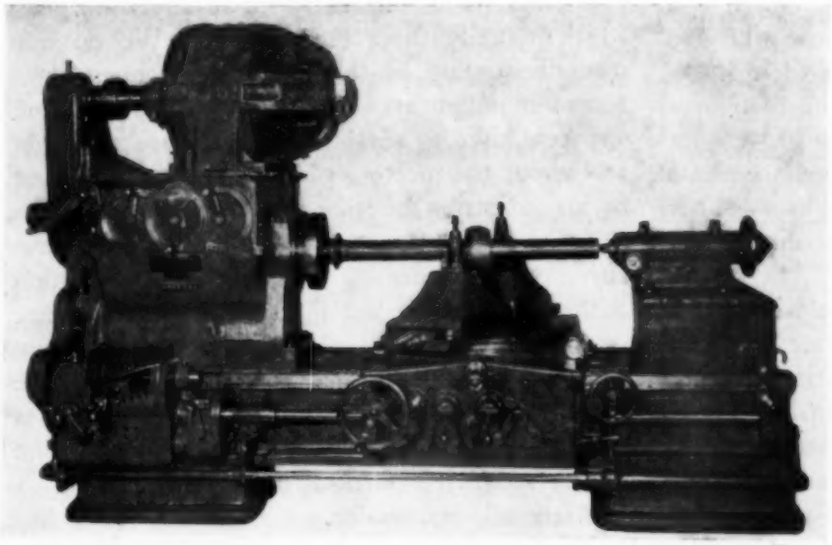


of the swivel type with ball-bearing wheels, permitting easy movement around short radius turns.

"American" Ball-Turning Lathe

An improved spherical or ball-turning lathe has been developed by The American Tool Works Company, Cincinnati, Ohio, for the turning of spherical portions of self-aligning bearings. The spherical-turning mechanism consists of heavy front and rear rests independently mounted on a substantial dovetail slide, and adjusted to various work diameters by separate screws. These tool rests are carried by a turntable mounted on a special carriage and actuated either by hand or power through a large-diameter bronze worm-wheel and hardened steel worms. Uniform cutting speed is maintained over the entire surface of the sphere. A speed-adjusting rheostat mounted at the rear of the bed is connected to the turntable of the spherical-turning attachment, and is controlled by its movement to speed up the motor as the cutting tool approaches the minimum diameter, and vice versa.

Because of the diameter of the spheres being turned, the spherical-turning mechanism is mounted on a 30-in. lathe. This lathe is equipped with a 12-speed, automatically oiled geared head, and is driven by a 30-hp., 2 to 1, adjustable-speed motor. Electrical speed variation is accomplished manually from the operator's position through the handwheel shown at the right of the apron and automatically through the speed-adjusting rheostat at the rear of the bed.



Spherical-turning mechanism mounted on an American 30-in. lathe and having uniform cutting speed for the entire surface of the sphere

TRADE PUBLICATIONS

BALL-BEARING PRODUCTS. S.K.F. Industries, Inc., 40 E. 34th St., New York, N. Y., has published Bulletin No. 204 illustrating its various products, such as ball, spherical roller and roller bearings, pillow blocks, hangers, and others.

COLLETS AND CHUCKS. The Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass., has issued Bulletin 100-A on its draw-in collets and chucks, giving cross-sectional views, complete specifications, and illustrations of the representative types.

FOREMANSHIP TRAINING. The Elliott Service Co., 242-250 West 55th St., New York, N. Y., has developed a foremanship service. The booklet "Management," problem questions, and points for discussion are issued every other Monday and in the intervening weeks the four-page leaflet "How Do You Measure Up?" is mailed to furnish foremen with means for checking themselves.

FOUNDRY TRADE CUSTOMS. The Gray Iron Institute, Inc., Terminal Tower Building, Cleveland, Ohio, has issued a revised edition of its pamphlet "Standard Sales Agreement and Trade Customs in the Gray Iron Foundry Industry."

GRINDERS, INTERNAL. The Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass., has available Bulletin 104-B on its internal-external precision grinder. The catalog gives a complete description of the machine, its operation, and methods of drive, together with complete specifications.

HOISTS, ELECTRIC. The Wright Manufacturing Co., Bridgeport, Conn., has issued a 48-page catalog on its hoists, giving a complete description of the construction, as well as dimensions and other data.

NICKEL CAST IRON. The International Nickel Co., Inc., 67 Wall St., New York, N. Y., has issued Bulletin No. 208 on "Ni-Resist," a Corrosion and Heat-Resistant, Nickel-Copper-Chromium Cast Iron, giving data on applications, welding, and the physical and chemical properties.

PULLEYS. The American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa., has issued a catalog of "American" Wedgbelt pulleys and drives. The booklet gives engineering information on V-belt drive design in concise form, and lists a wider selection than common of center distances in all standard ratios.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, May 14, 1931

VOL. 74 NO. 20

The American Machinist Awards

SINCE 1924 *American Machinist* has had under way constantly at least one series of articles urging the replacement of obsolete and wasteful production equipment. At times there has been some overlapping of these series.

Two inventories of obsolete equipment have been taken, one in 1925, the other in 1930. The effectiveness of the replacement campaign is proved by the fact that the percentage of returns on the 1930 questionnaire was fifty per cent more than the gratifying high return on the earlier one. And this in spite of the much greater complexity of the 1930 questionnaire and the larger list to which it was sent.

It has been pointed out to users of metal-working and auxiliary production and maintenance equipment that sound management policy requires the elimination and replacement of that portion which is obsolete; that modern machinery will make considerable increases in output per unit; that it costs real money to keep old equipment in service.

The general principles of equipment replacement have been accepted by production executives. Many of them have gone part way in applying the principles, some have gone all the way. To extend some small recognition to those who are doing a real job in saving money for their stockholders and their customers by keeping their production equipment up to date, and to prove once more to those who may still be unconvinced how important it is adopt a similar policy, two awards have been established which are described in detail on following pages.

Profit will not be confined to the winners of the contest. Every company that enters the contest, and reduces its own plan to writing for that purpose, will get a better comprehension of the whole subject of equipment replacement and will undoubtedly discover ways to improve on the existing plan.

These awards represent the latest step in a campaign that has gone forward steadily for more than seven years, and will continue so long as the need for it exists. Because shops outside of the United States and Canada are not eligible to compete for the awards, the pages giving the details are not included in the European Edition.

Swapping Machines

SWAPPING machine equipment isn't always an unmixed blessing. It frequently results in getting machines that are not the best for the purpose. Perhaps the maker of the machine best adapted to our purposes does not need one of our machines, or is not in the swapping mood.

In some cases, however, the gentle art of trade and barter has worked out very well during the past year. One concern made a study of its equipment needs and then canvassed the shops of the concerns making the machines wanted, to see where its own products would fit in. To date it has installed about a dozen new machines, secured in exchange for machines of its own with very little money changing hands in any case. This means that about two dozen new machines are in place in the various shops, ready to cut costs when business comes, if indeed they are not already showing savings on the cost sheets.

Sentiment Improves

MOST of us have had sufficient experience with business and association gatherings to recognize that what is said from the platform may be addressed to an audience much larger than, and quite differently made up from, that which actually faces the speaker. We do our own discounting of these public statements and form our judgments accordingly. What the same speakers have to say in informal conversation in and about the meeting place is far more reliable as an indication of their true feelings.

It is encouraging to be able to report, therefore, that informal expressions of opinion gathered at the recent meeting of the Chamber of Commerce of the United States evidenced considerable confidence in the immediate future. Pessimism was largely absent from the attitudes of business men and manufacturers coming from widely separated portions of the country.

After all, restoration of confidence is the key to business revival. And, what is more, it is contagious.

Management Speaks Its Mind

An analysis of 800 responses to the McGraw-Hill "Platform for American Business"

(SUPPLEMENT TO AMERICAN MACHINIST, MARCH 5, 1931)

I—*Introduction*

A FRANK expression of opinion from eight hundred business executives on any subject pertaining to present economic conditions in this country is both unusual and important. If these men happen to be chairmen, presidents and vice-presidents of prominent organizations, selected from all branches of American industry and business, it becomes of vital interest. For they are responsible for the conduct of our great corporations and the policies that control their operations. The progress of our highly industrial civilization lies largely in their hands and the trend of their thinking exerts a profound influence on the affairs of all men. Their mass opinion, right or wrong, will direct the course of current business enterprises, affecting both the worker and the investor in all walks of life. But the opinion of this group will not be found far wrong, because it represents the broadest experience and the most constructive brains in this country.

Such an opinion has recently been recorded in a discussion of "A Platform for American Business," presented in twenty-two McGraw-Hill publications during the month of March. Advance copies were sent to four thousand men, at the head of almost as many companies, large and small, and including the most distinguished leaders of our business world. In letters of from one to five pages, eight hundred of them commented on the principles embodied in the Platform. They discussed frankly and confidentially the causes of the present economic depression and what American business must do to insure a more stabilized program from now on. And with all their diversity of interest and variety of opinion, their combined judgment has expressed so definite an attitude, that it is entitled to consideration.

Naturally so large a mass of correspondence presents a difficult problem in analysis. But out of it come distinct impressions, clearly stated by individuals and supported by a preponderance of testimony. Their criticisms are candid and their recommendations are direct. How they feel can best be pictured by breaking down these mass reactions into the major themes that have been most discussed because considered most important.

II—*Living Standards and Unemployment*

IT IS a fair statement that no single issue before American business today is receiving as much earnest thought as the broad problem of the social responsibility of industry. The Platform made two portentous statements on this point: first, that if American business does not develop a more effectual system of self government it can look for an extension of state and federal control; and second, that if industry does not find a way to assure continuity of employment and security to the superannuated worker, it can expect socialistic legislation that will eventually lay the burden upon business through taxation. Ten years ago such a declaration would have been denounced. But in these comments on the Platform this principle has received an almost universal endorsement. It is an astonishing expression of the awakening social consciousness of industry.

There is an appreciation that the whole structure of our modern social and economic life is founded on high standards of living that have established the consuming power of the masses as the outlet for the wealth created by a vast mechanized industry. It is recognized that just as the riches of ancient Egypt, the culture of Greece and the glory of Rome were based on the productive power of a great mass of slaves, just so the prosperity of modern America is built upon the mechanical horse power that has been organized behind each worker. It has been made possible for free men to create wealth on a large scale without slaves and to enjoy an income great enough to give them, in the mass, the power to consume this wealth which has been created. And this is now accepted as the American manner of living. This standard is expected still further to increase and to be adopted gradually by the other peoples of the world.

At the present time, as many men point out, technical advance is not possible without some temporary unemployment during the lag between the installation of the labor saving machine and the employment of the released operator in other work. This lag may be shortened, however, and the distress of unemployment relieved in two ways—through better planning by industry to re-employ the released worker more promptly and by the cooperation of the worker, as these comments attest:

"Wage earners buy the bulk of all consumer goods. They must be taught to accumulate savings, so they can buy goods, produced by other workers in slack times when wages are low and goods cheap. We must promote thrift and saving by education, for men can save by the installment plan as well as buy that way. Extravagance and high standards of living are not the same thing."—*from the head of an advertising agency.*

"The need is for education and cooperation on old age pensions and unemployment insurance, coupled with conservative accounting and adequate reserves for plant, advertising, research and employee benefits, so that when poor years strike, we may go on building for the future."—*from the president of a great electrical industry.*

"Employed persons in all walks of life are chiefly concerned with security of employment. The great problem is—can our employing groups find a way to apply reserves accumulated in times of plenty to give employment in periods of depression. I believe that industries may eventually cooperate to effect such a guaranty. For the reserves of corporate undertakings belong in part to employees as creators of the business."—*from an eastern state chamber of commerce.*

"We take depreciation on buildings and equipment but none on labor. We must have a labor depreciation account—call it old age insurance or employment reserve—but it is coming."—*an engineering firm.*

"Eliminate the exploitation of labor as a competitive weapon. If per capita consumption of consumer goods remain constant and the productivity of man power is further increased, we must shorten the hours of labor."—*from a state governor.*

This is the trend of opinion among these eight hundred representative executives of American business. Other

opinions are expressed of course. Several men blame high pressure easy payment sales with debauching the purchasing power of the masses. Some demand a reduction of wages. A few question the possibility of still further improvement of living standards. Some doubt the prudence of attempting to make work in slack times. But the consensus of judgment is as these quotations have reflected it—a recognition of the social responsibilities involved in the absorption of the working lives of men and women by industrial and business enterprises and a determination that something must be done.

III—*Stabilization of Business Progress*

IF AMERICAN standards of living are to be preserved and if the costly consequences of periodic large scale unemployment are to be avoided, definite measures for the stabilizing of business progress must be organized into our economic life. Action must be initiated by the executives of industry and by those men who control the banking institutions of the country. There is apparently no lack of crystallized opinion in the minds of business men today as to some of the principles that are involved and some of the measures that should be taken.

We have developed a great system of mass production and have created vast capacity for manufacture in this country. As the chairman of a railroad points out, there is in this no danger of the over-production of wealth, but there is danger of the over-production of definite products. While half the population of the world is living on a standard that to us would be comparable to one meal a day, with all our capacity we could not produce more than the world could consume. But products must be distributed to the consumer and it is here that our system breaks down. Our production and our distribution are not in balance and we go forward in cycles of succeeding glut and shortage, reacting blindly to the influence of surging waves of demand that drown themselves in a flood of products, because they are all dumped in one place at the same time and therefore cannot be absorbed.

There is a preponderance of opinion in these letters that the heart of the difficulty lies in the present lack of control over preventable inflation and deflation and here the finger is pointed straight at the banker. He is the man, these executives say, whose function it is to exercise a restraining influence over industry. But he has failed to do so. Let some quotations speak:

> "There is room for effective education in the responsibility of the banks toward inflation and deflation. The average banking institution has been prone to facilitate excessive inflation in times of prosperity rather than check it, while when they become frightened in times of depression, they advocate excessive deflation."—*from the head of a large financial organization.*

> "The great hindrance to accomplishment lies in the inability to standardize the viewpoint of our financial leaders regarding business morality."—*from a power company president.*

> "Excessive inflation in times of prosperity is caused by our extended credits, merging of corporations for stock selling purposes, dissipation of funds that should be set up as accumulated reserves instead of paid out in dividends in order to stimulate new financing and more speculation in stocks. The proper control of banking facilities is a most important factor in the stabilizing of business progress."—*from a manufacturer of aircraft.*

> "The bankers may have to be educated to thinking in terms of long term financial assistance if individual companies are to continue to live."—*from a machinery manufacturer.*

It is recognized, of course, that the industrialist himself has been the chief cause of the inflation that precipitated the present bad times. As one New York banker points out:

> "One of the underlying causes of the business depression was that so many business men were not sticking to their knitting, but devoting too much time and effort to the speculative markets. Their own businesses were drying up but these difficulties were being offset by the considerable sums they were making in the stock market. Many could have corrected their situations if they had spent more time on their legitimate affairs."

To which another adds this warning:

> "One factor which contributed to speculative contagion was the vast corporate reserves thrown into the call money market. We shall some day require some joint assumption of responsibility by the broker who seeks large commission earnings and groups who lend money for speculative purposes."

Throughout these statements by these men at the head of corporations of all sizes, allied with varied industries, the chief emphasis is placed upon the need for better planning in business operations, in finance, production, employment and sales. Time and again the point is made that there must be more science and more judgment in the use of the resources of industry—money, plants, personnel and markets—and that the same principle advocates the maintenance of money invested in raw materials as in securities and calls for like care of funds invested in equipment, in employees and in established products and customers. Only in this way do they see the hope of an effective restraint upon the enthusiasms that inspire inflation in every period of prosperity.

The general testimony indicates an almost uniform approval of this recommendation for business planning over a longer period, for example:

> "I am in hearty accord with necessity for methodical planning for future periods, coupled with intensive budgeting. If transportation companies could be impressed with the necessity for such vision, we would see improvement in transportation affairs. Executives have lost sight of the necessity for a long distance target to shoot at."—*from the president of an electric railway.*

The need for long term planning in particular situations is cited in many letters, and also the difficulties. Particular stress is laid upon the importance of planning in production and market research, in product development and in sales. The following quotations are typical:

> "Start your Platform with a movement to encourage a planning production for a long period. It will be difficult for many industries because of rapid changes in products and methods but it would help stabilize business as much as any one thing."—*from the president of a large tool company.*

> "There is too much neglect of research and development of tonnage markets for products already made while large sums are often expended in developing new process requiring new equipment in order to effect a few per cent greater yield. Greater product consumption is quite as important as greater process improvement. Planning will do it. The whole idea of budgetary control falls down without accurate sales forecasting."—*from an engineering organization.*

> "There is sufficient organization today in the world of industry, commerce and finance to bring into being the machinery for some conscious guidance of economic forces, if leadership would assert itself. Organized labor should be definitely included in the machinery for conscious, intelligent planning. Unless industry takes a grip on the problem, a bewildered but more or less desperate mass of population will turn to political action, bringing us to what degree of bureaucracy we know not."—*from an international news service.*

IV—*The Opportunity for Cooperation*

THE LAST quotation strikes a note that runs strongly throughout this remarkable expression of executive opinion on this engrossing subject. Once we have

agreed that the hope for a greater stability in American business rests upon the general practice of a more intelligent degree of long term planning, we are immediately confronted with the unanswerable question—How far is business to be permitted to go in its planning? So complex are the inter-relationships between the units of an industry today and between industries, that any broad program of planning must involve cooperation, coordination and control. And this bears directly upon national laws regulating the freedom of private initiative, upon political considerations affecting the participation of government in business, and again upon the policies of nations as they influence foreign trade.

On this theme also, the writers of these letters have expressed themselves freely and in no uncertain terms. There is a remarkable difference of opinion recorded. On the one hand it is generally recognized that our prevailing anti-trust laws need revision because they have in themselves created evils by interfering with constructive coordination and inducing destructive forms of competition. But from the other angle there is lack of faith in the vision of business management, a fear of its selfishness. Men wonder how much freedom industry can safely enjoy.

These two clearly defined schools of thought—one demanding less restriction and the other questioning the ability of business to keep itself clean without government regulation—are well represented by the following comments:

"Business men should strive toward these ends—less government activity in business, cessation of attempts by government to stabilize prices by means other than the law of supply and demand, and the modification of the Sherman Act as it applies to the development of natural resources."—*from the president of a large copper company.*

"Many of our laws now controlling mergers will have to be changed to meet modern conditions. Regulatory legislation should be flexible, framed to correct abuses when they occur, but otherwise to allow wide lattitudes."—*from a western state chamber of commerce.*

"Unless our industrial leaders will recognize that excessive and unbalanced industrial and financial expansion must be curbed, and are willing to take the time for thought and action, we will have a number of interstate commerce commissions controlling the several branches of industry just as they do the railroads, but with expanded powers."—*from the president of a steel works.*

"I do not believe it is to the interest of business in general to have business free from government regulation or control. It is sounder economics to encourage private initiative to expand and enlarge and even monopolize certain branches of industry and trade, but with proper governmental supervision to see that this privilege and power are not abused."—*from a western firm of accountants.*

"Business must clean house if it is to avoid further governmental interference. There are various abuses widespread in business, some tending to become worse. The executive who says he is powerless until the trade association takes action, is merely waiting for eventual government interference. We must have more business leadership, with an observance of high standards by the individual without waiting for group action, if we are to maintain our present independence."—*from a college of business administration.*

"Cooperation has become increasingly destructive due to the struggle for markets to support mass production and to anti-trust laws which do not fit our industrial situation. If we are to have the kind of cooperation in industry that will bring stability in employment, we must have governmental regulation. We can only change our anti-trust laws by substituting regulation. If our great industries can be allowed to make a reasonable profit, keeping alive the competitive system but holding it in bounds, a long step will be taken toward avoiding booms."—*from a machine tool manufacturer.*

The letters contain many other reflections on this general theme—the trouble caused by selfish competition, the difficulty of maintaining high ideals in our large impersonal organizations, the importance of business men taking more interest in government, the burden of taxation, the opportunity of a greater service from our government in the collection of information on distribution and consumption, and the possibilities for reserving public works to make employment in periods of depression. The chief interest, however, centers in this question of the regulation of business, with an apparent preponderant belief that even more control will be needed unless business management itself immediately sets up the safeguards that public opinion is demanding.

On this broader phase of cooperation through industry and trade associations, the following quotations are typical:

"Trade associations have failed to stabilize or improve conditions to the extent that should have been possible. The trend is now to eliminate unnecessary and inefficient associations and strengthen the more important groups."

"Rival associations, promoted for the purpose of furnishing a job for the secretary, should be discouraged. Business should center its support on some organization qualified to speak for it."

These are both from heads of industry organizations. If the meager consideration of this subject in these letters can be taken as an indication, the possibilities even under existing laws, for service and leadership from such associations, if properly set up and supported, is clearly not appreciated by business management today. This despite the fact that there are many hundreds of them now in operation, with many notable examples of outstanding achievement.

V—International Cooperation

On the subject of international cooperation, though much was written, again the reaction is vague and scattering. It is readily acknowledged that "our prosperity and welfare is undeniably interwoven with that of the rest of the civilized world" to quote the president of an advertising company. But discussion quickly breaks down, usually into some reference to the obstacles presented by differences in living standards and to reflections on the tariff argument. There is, perhaps, no single phase of this unusually frank and free expression of what American business management is thinking about the present world wide economic situation, more striking than the almost total absence of definite opinion on the broad topic of the inter-relationships of companies within an industry and the inter-dependence between industries and between peoples.

In these days of instantaneous communication and easy contact between all nations and the inter-change of goods and services throughout the world, it is no longer possible for countries to live in isolation or ignore the interests of the other commonwealths. It is likewise no longer possible to think in isolation, for the economic affairs of every neighbor nation come crowding into the picture. It was for this reason that the "Platform for American Business" gives so much attention to the promotion of national prosperity and the maintenance of world business, through industry coordination and international cooperation, as a vital concern of any well planned company program. This suggestion was well received in the discussion of the "Platform." But these eight hundred executives of American business have very little to say on the subject—which is something to think about seriously.

AMERICAN MACHINIST *1931*

for most effective

Two prizes to be awarded for the outstanding examples of efficient machine tool and production equipment replacement in their relation to lowered costs to the manufacturer and increased value to the customer

American Machinist is establishing two 1931 Awards for Replacement Policies—

To give recognition to the accomplishments of forward-thinking management.

To stimulate interchange of information on replacement policies.

To lead the way toward realizing on the opportunities of the future for still further increasing the purchasing power of the dollar for manufactured products.

Classification of Entrants

Classification of companies entering the contest will be according to their output, namely,

(I) Companies whose average output is 1,000,000 dollars or more.

(II) Companies whose average output is 999,999 dollars or less.

The two awards are to be made to companies operating in the United States or Canada.

Basis of Awards

Both Awards will be based on:

1. The record of results achieved in terms of lowered costs to the manufacturer, or increased value of product to the customer, or both.
2. The explanation in detail of the methods and practices used to get these results.

For the outstanding example of efficient and comprehensive systems, methods and practices followed by the companies in Group I, a medal plaque, a certificate of award and $500 in cash to be disbursed to the individual or individuals designated by the winner company.

For the outstanding example of efficient and comprehensive systems, methods and practices followed by the companies in Group II, a medal plaque, a certificate of award and $500 in cash to be disbursed to the individual or individuals designated by the winner company.

It would be manifestly impossible to make the intrinsic worth of these awards indicate any measure of the importance or the value of the service in commemoration of which they are presented. The intent is rather to give industry recognition and to express appreciation publicly for the contributions made to the advancement of better and more efficient equipment replacement practices in the metal-working field.

The interchange of ideas, knowledge and information which these awards will make available should stimulate further the widespread interest in this most important phase of factory operation. The development of the report may also result in still more efficient management in the plant by which it is submitted.

Conditions and Suggestions

It is suggested that entrants submit their data for the consideration of the judges in the form of a brief. Duplicate copies are requested—an original and a copy. The original becomes the permanent property of *American Machinist*, while the copy will be returned on request of the entrant company after the winners of the awards are announced.

In preparing the brief it is suggested that a chapter arrangement be adopted and that the system of replacement followed be outlined in narrative form, accompanied by such figures, illustrations, photographs and exhibits as may be deemed necessary. To hold down the expense of preparing briefs, decorative art work should be avoided. A typewritten statement (double spaced) that sets forth the facts is concisely as possible, but which contains all essential details, will be adequate.

It is further suggested that the briefs consist of three parts, as follows:

1—Introduction
2—The Methods Employed
3—The Results Achieved

Varying conditions of product, volume and plant operation make impossible any standard outline of facts to be presented. The following are suggested items to be considered:

Awards

All manufacturers in the field of *American Machinist* are cordially invited to participate. Briefs must be submitted on or before September 1, 1931.

Replacement Policies

1. Introduction

A statement by an officer of the company that average annual total product shipped, in 1928, 1929 and 1930, had a sales volume either more than or less than 1,000,000 dollars.

General summary of the company's manufacturing operations, with information as to its products.

Inventory of production equipment, giving age, per cent of full-time operation, etc., if readily available.

Accounting practices bearing on replacement policies, such as depreciation rates, reserves for new equipment, etc.

In general, submit information which will depict the character and volume of the production operations. When available, photographs of the latest types of equipment and of the shops should be included.

2. The Methods Employed

A complete, detailed presentation of the entire system of replacement, with specific applications. Methods employed to determine advisability of replacements such as formulas for determining savings from new equipment, period in which new equipment must earn its cost, or any other empirical methods adopted.

Accounting practice on equipment repair costs and on idle machine time due to repair of equipment, with its bearing on replacement decisions.

Weight given to improved quality of output, savings in assembly because of higher precision, and similar items, in making replacement decisions.

Data on as many specific machines as may be available, showing the practical application of replacement policy.

3. The Results Achieved

A broad picture of the results of replacement policy from the standpoint of management, in reduction of over-all production costs, or improved quality of product, or both.

Examples of lowered costs on specific cases.

Statements comparing efficiency of new equipment with that replaced.

Effect of systematic replacement in improvement of product, which may be expressed in comments from sales executives or from customers.

Effect of systematic replacement in reduction of maintenance costs, idle machine time for repairs, maintaining of production schedules and deliveries, etc.

In general, the benefits accruing to the business as a whole from the replacement system used by the manufacturer.

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JUDGING THE AWARDS

Selection of the companies to be honored by these awards is left entirely to the discretion of the Committee on Awards who will chose the winning company in each group.
The Committee on Awards consists of five men:

Dexter S. Kimball, Chairman,
Dean of Engineering, Cornell University

Dr. Julius Klein,
Assistant Secretary of Commerce

Harold V. Coes,
Manager, Industrial Dept., Ford, Bacon & Davis, Inc.

Fred W. Shibley,
Vice-President, Bankers Trust Company

Kenneth H. Condit,
Editor and Publishing Director, "American Machinist"

It is the function of the Committee on Awards to review the briefs submitted in each class and from the evidence submitted to determine the winners.

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All briefs must be in the hands of the Chairman of the Committee on Awards, care of *American Machinist*, McGraw-Hill Publishing Company, New York City, on or before September 1, 1931. Companies that plan to file briefs are urged to notify the Chairman of the Committee of their intentions as early as possible. Submission of a brief carries with it the privilege of publication in whole or in part over the name of the company.

The Awards will be announced during the month of October, 1931.

NEWS OF THE WEEK

Gear Makers Hold Annual Meeting With a Number of Good Papers

Buffalo, N. Y., May 9—Pres. B. F. Waterman opened the 15th annual meeting of the American Gear Manufacturers' Association at the Hotel Statler on May 7. The high spot of the first day's session was the presentation of C. W. Gansur's paper on "Non-Metallic Gears and Their Operating Characteristics." This provoked a spirited discussion on the application of these gears and their limitations. Among the committee reports, that of the inspection committee stood out. Its findings were adopted as recommended practice. R. V. Baud presented a paper on the "Photoelastic Study of Contact Stresses in Gears" at the evening session. This included new data on tooth loading.

On Friday morning, B. F. Waterman of Brown & Sharpe was re-elected president, E. W. Miller of the Fellows Gear Shaper Co. was elected first vice-president, and John Christensen of the Cincinnati Gear Works, second vice-president. Warren Jones of the W. A. Jones Co. was elected treasurer. Executive committee members, F. B. Drake, E. S. Sawtelle, E. W. Miller, and P. L. Tenney, were all re-elected.

E. S. Sawtelle, Chairman of the Commercial Standardization Committee, spoke on "Stick to the Uniform Standard in Cost Accounting and Price Building." The topic, "How We Build the Sale Price of a Gear," was discussed by Wm. F. Coleman, W. F. Weeks, D. W. Mort, and L. J. Flynn. In the afternoon, "Mark Up on Raw Material," was the subject of C. B. Hamilton, Jr., E. P. Connell, and Paul Christensen. J. H. Jackson presented a revision of the Recommended Practice Standard. R. W. Lindsey, Vice-President of Pratt & Lambert, was the principal speaker at the Friday evening banquet and spoke on "Mind Your Own Business." This morning was devoted to committee reports, which included a paper by Earle Buckingham on "The Strength and Durability of Spur Gear Teeth." *AM*—Vol. 74, page 707.) This presentation covered an entirely new conception of the dynamic loading of gear teeth which revises gear strength formulas.

Opinions Differ On International Chamber

Washington, D. C., May 9—Wide variation exists among competent observers in the appraisals of benefits flowing from the sixth congress of the International Chamber of Commerce. An intelligent business man can learn more in a week at a meeting of this sort, some think, than he could in ten years at home circumscribed by his local horizon. At home the tendency is to concentrate on an effort to lift one's self by his own boot straps. To be at the center of things in a great world clearing house of ideas stimulates such a man to take broader views.

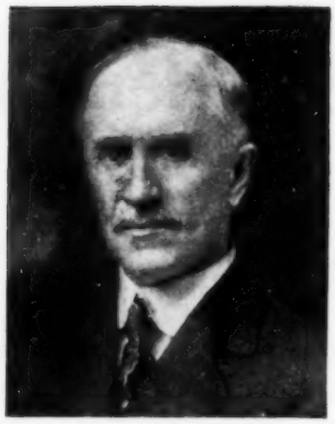
Those who see the other side of the picture are more numerous. Many are inclined, along with Will Rogers, to regard such a gathering as a men's sewing circle characterized chiefly by prattle and inability to harmonize opinion. Much disappointment is voiced because of the lack of concrete suggestions as to what can be done to improve the business situation.

Foundrymen Meet in Chicago

Chicago, Ill., May 8—The 35th annual convention of the American Foundrymen's Association here attracted a larger number of visitors and exhibitors than that of 1929, and also elicited more interest, both in displays and in the technical program. It was the most extensive program so far planned by the AFA, and foundrymen's interest in it was shown by a registration of more than 2,600 by the second day, greater than the attendance at the 1929 meeting under the same roof. There were 167 exhibitors, as compared with 152 in 1929.

The large exhibition hall of the Stevens was devoted to both models and full-size machinery and the supplementary conveying, sand conditioning, casting finishing and cleaning equipment. The ball room exhibition space, bringing the total to more than 45,000 sq.ft., showed a wide variety of supplies, metals, core oils, measuring and testing instruments, and association and publication booths.

The meeting was exceptional for the interest shown in sessions. Many sessions overflowed the space allotted, including some of the discussion groups, shop-operations courses and luncheons. The meeting served to show the increasing importance of the metallurgist in the foundry, and also the increasing adaptation of microscopy, photomicrography, and X-ray and Gamma ray methods of casting examination.



James N. Heald

James N. Heald, 66, President and General Manager of The Heald Machine Company, Worcester, Mass., died there shortly before midnight May 6. He had been in poor health for several years, and for several months past his condition has been serious. His death was due to a heart affliction.

James N. Heald was born in Barre, Mass., Sept. 21, 1864, the son of Leander S. and Ann A. Heald. His early education was in the schools of Barre, and he was graduated from the Worcester Polytechnic Institute in 1884.

Immediately after graduation he entered the family business at Barre. Its history has few counterparts anywhere in the United States for unbroken ownership and management in one family. Four generations have participated. James N. Heald was the third. The house was established in 1826, 105 years ago, by Stephen Heald. Stephen Heald's son, Leander, was taken into the partnership as S. Heald & Son, and when James joined the business both grandfather and father were still running it. When Stephen Heald died in 1888, the firm became L. S. Heald & Son and James took over the management.

In 1903, the son bought out the father's interest, organized The Heald Machine Company and transferred the business to Worcester. At the time of his death, Mr. Heald had turned over many of the duties of management to his sons. Roger N. Heald is vice-president and works manager and Richard A. Heald is secretary and treasurer.

Mr. Heald was a director of the Worcester Bank & Trust Co. and a trustee of the People's Savings Bank. He was for many years a member of the National Machine Tool Builders' Association, and served as its treasurer and for three years on its board of directors. He was a member of the A.S.M.E. and the S.A.E.

He married, Sept. 19, 1894, Mabel Allen, daughter of Charles G. Allen of Barre. She survives her husband, as do their four sons, Roger N., Richard A., Robert S. and Stanley W. Heald.

A.S.T.M. Nominees

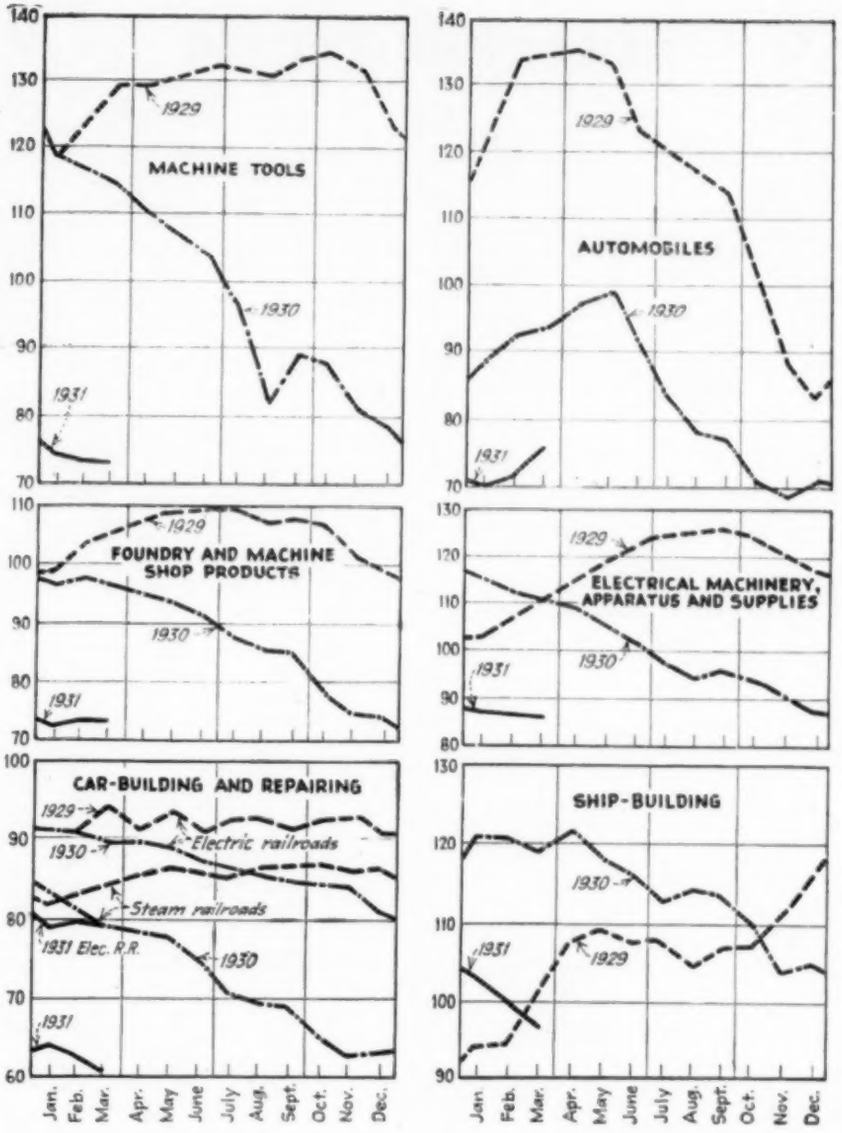
The following nominations for officers have been announced by the American Society for Testing Materials: For President, F. O. Clements, Technical Director, Research Laboratories, General Motors Corporation; for Vice-President, S. T. Wagner, Consulting Engineer, Reading Co.; for members of Executive Committee, Arthur W. Carpenter, Manager of Testing Laboratories, B. F. Goodrich Co.; K. B. Cook, Technical Manager, Manville Jenckes Co.; G. C. D. Length, Consulting Engineer and Secretary, Clay Products Association; O. L. Moore, Engineer of Tests, Universal Atlas Cement Co., and J. B. Johnson, Chief, Materiel Section, Air Corps, U. S. A. The official ballot will be issued to members somewhere between May 20 and June 1 and the result will be announced at the annual meeting in Chicago in June.

Metal-Working Equipment Leads Machine Exports

Industrial machinery exports from the United States in March registered a slight advance over the total for the preceding month, according to the Commerce Department, Industrial Machinery Division. Although this figure represents a considerable drop under the total for the corresponding period of 1930, it still indicates substantial business, approaching more nearly the monthly returns compiled during 1927-1928. The extent to which the above decline has been carried is better illustrated upon a comparison of the totals for the first quarter of the present year with similar figures for 1930. During the period, January to March, 1931, shipments of industrial machinery abroad amounted to $40,326,000, as against $66,275,000 established during the same period last year.

The trade in metal-working machinery, which maintained its position as leading item of machinery exports, was the most encouraging feature of the quarter. The figure of $10,500,000 established for the three-month period is an extremely creditable showing in the face of a steady drop in purchasing power abroad. Activity in this trade was stimulated to a large extent by foreign shipments of commodities comprising the power driven type of metal working machinery particularly sheet and plate metal working equipment, lathes, and forging machinery.

APRIL output of motor vehicles in the United States and Canada was 348,909 units, an increase of 21 per cent, compared with the total for March, but a decrease of 25 per cent from the total for April, 1930, according to the National Automobile Chamber of Commerce. In 1930, the increase in April over March was 12 per cent. The chamber also estimated the four months' output of this year at 1,046,399 units.



TREND OF EMPLOYMENT IN METAL-WORKING INDUSTRIES

Monthly average for 1926 = 100. Data supplied by the Bureau of Labor Statistics.

Machine Shop Practice Training Developed

The American Machinery and Tools Institute, in cooperation with the Lewis Institute, has developed a machine shop practice program for training mechanics. An applicant for this Machine Practice program must be a high school graduate or have had satisfactory industrial experience. This training requires two years of forty hours per week. The completion of the training and instruction given by Lewis Institute and one year of satisfactory service in one of the shops affiliated with the American Machinery & Tools Institute will qualify the candidates for the title of Associate in Mechanic Arts.

A.S.M.E. Plans Lubrication Meeting

Under joint auspices of the Pennsylvania State College and the Lubrication Engineering Committee of the Petroleum Division of the A.S.M.E., a one-day lubrication meeting is to be held on May 22 at State College, Pa. Technical papers are included in the program as is the lubrication research session and a symposium on internal-combustion engine lubrication. Papers include: "Lubricant Testing," by E. G. Boden, Engineer and O. L. Maag, Chemist, Timken Roller Bearing Co.; "Bearing Design in the Light of Recent Research on Oil-Film Pressures," by L. J. Bradford, Professor of Machine Design, Pennsylvania State College, "Fluid-Film Lubrication as Applied to Railroad Journal Bearings," by F. O. Willhofft, Secretary and General Manager, Isothermos Corporation of America, "Oral Discussion of Lubrication of Railway Bearings," by M. E. McDonnell, Chief Chemist, Pennsylvania Railroad.

FEDERAL Specification QQ-I-666, superseding USGMS 378a on Malleable Iron Castings, is being submitted to industry for criticism and comment.

BUSINESS ITEMS

Manning, Maxwell & Moore, Inc., announce their withdrawal from direct sales representation of Putnam machine tools and Shaw overhead electric traveling cranes in the Chicago territory. The local sales branch was closed May 1 and the Dean Machinery Co. has been appointed representative. R. S. Dean, President of the Dean Machinery Co., has been connected with Manning, Maxwell & Moore, Inc., for 22 years. For the past few years Mr. Dean has been manager of the M. M. & M. Chicago branch. The new Dean Machinery Co. offices are 80 East Jackson Blvd., with warehouse at 2601 Cottage Grove Ave. The Chicago office of the Consolidated Ashcroft Hancock Co., Inc., a subsidiary of Manning, Maxwell & Moore, Inc., will continue to operate without change.

The Pacific Car & Foundry Co., Seattle, which recently purchased the Bacon & Matheson forge plant in Seattle, has also recently purchased the Arrow Pump Co. of Seattle, and will merge it with the company's holdings at Renton. The Arrow company manufactures a pump used in oil and mining work, while the Bacon & Matheson Co. has been in business in Seattle since 1886.

The McCabe & Sheeran Machinery Corporation, 50 Church St., New York, N. Y., has taken over for complete liquidation the plant of the Brown Manufacturing Co., Zanesville, Ohio, manufacturer of agricultural implements. McCabe & Sheeran is also liquidating the former lathe manufacturing plant of the Houston Stanwood & Gamble Co., Covington, Ky.

The Industrial Plants Corporation of Ohio, with offices in the Columbian Building, Columbus, Ohio, will sell the entire machinery and equipment, supplies, fixtures, etc., of the Knight Manufacturing Co., 1510 Market Ave., South, Canton, Ohio, at absolute public auction on May 14 starting at 10:30 a.m.

The Grindle Fuel Equipment Co., Harvey, Ill., a subsidiary of the Whiting Corporation, has purchased exclusive manufacturing and selling rights to the Bethlehem pulverizer, formerly manufactured by the Bethlehem Steel Co.

S. M. KINTNER

A charter for Dominion Motors, Ltd., the new concern formed by Charles W. Nash, of Nash Motors, Kenosha, Wis., and Roy D. Kerby, President of Durant Motors of Canada, has been issued. Dominion Motors, Ltd., the charter provides, is incorporated for the purpose of manufacturing automobiles, trucks, etc., and is empowered to acquire the capital stock and assets of Durant Motors of Canada, subject to the ratification of the shareholders.

Aluminum Industries, Inc., Cincinnati, Ohio, has opened a Chicago branch at 1923-25 South Wabash Ave. It was opened and will be operated under the name of the Warehousing Service Co.

The Melchior Armstrong Dessau Co., 116 Broad St., New York City, has been appointed European sales agent for the W. M. Chace Co., Detroit.

The Roberts-Moore Co., 140 First St., San Francisco, has taken over the business of the Roberts Welding Equipment Co., successor to Roberts & Peterson. Officers are: President, Charles E. Moore; vice-president, J. A. Roberts; and secretary-treasurer, K. R. Thiele. Mr. Moore and Mr. Thiele hold similar offices in the Herberts-Moore Machinery Co., but the two firms operate independently.

The Brattlebore (Vt.) branch of the Millers Falls Co., Greenfield, Mass., is being moved to Greenfield. It will occupy apart of the Goodell Pratt plant, which company was recently merged with the Millers Falls interests. The Brattleboro branch manufactures automobile jacks and will be in charge of Kenneth H. Saunders as previously.

The Robert Mitchell Co., Montreal, has brought together its iron and brass foundries under one roof at the new St. Laurent plant, and additional equipment has been installed.

The Bay Counties Steel Products Co. is installing machinery in 2,800 sq.ft. of floor space at 9601 Russett St., Oakland, Calif., for the manufacture of light steel stair treads, ornamental iron products, gratings, and pump screens. L. C. Young and H. D. Beasley are partners in the enterprise.

Installation of equipment in the new foundry of the Sibley Machine Co., South Bend, Ind., has started. The plant is on West Eckman St., and a new building for it has just been completed. It replaces the old foundry on East Tutt St.

PERSONALS

James C. Armer, Vice-President of the Dominion Forge & Stamping Co., Walkerville, Ont., has been named chairman of the Ontario division of the Canadian Manufacturers' Association.

Myron H. Clark has been elected vice-president in charge of operations of the Reading (Pa.) Iron Co.

Garret A. Connors has been appointed vice-president, director of purchases of the Truscon Steel Co., Youngstown, Ohio. In his new capacity, Mr. Connors will have complete charge of purchases for all Truscon plants, maintaining headquarters in Youngstown.

J. D. Chisholm has been appointed Toronto manager of the Harland Engineering Co. of Canada, Ltd., Montreal. For four years Mr. Chisholm was assistant electrical engineer with John Stadler, Consulting Engineer, Montreal, and later was on the staff of the Canadian Westinghouse Co., Ltd.

Edward L. Forstner has been elected President of David Lupton's Sons Co., Philadelphia, to succeed David D. Lupton, who becomes chairman. H. C. Grubbs, formerly vice-president of R.C.A.-Victor, Inc., has been elected Lupton vice-president.

Henry J. Gaisman, founder of the Autostrop Safety Razor Co., has been elected chairman of the Gillette Safety Razor Co., Boston. Gerard B. Lambert has been elected president.

Willis D. Gradison has been elected a director of the National Pumps Corporation, Chicago, to fill the vacancy caused by the resignation of Murray Smith.

William L. Hartley has been appointed district sales manager in charge of the Detroit territory for the Link Belt Co., 910 S. Michigan Ave., Chicago. His offices will be at 5930 Linsdale Ave., Detroit.

S. M. Kintner, Assistant Vice-President of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been elected vice-president in charge of engineering to succeed W. S. Rugg, who has become vice-president in charge of sales.

Arthur Krueger, Canadian Sales Manager for the Graham-Paige Motors Corporation, has been appointed managing director of the Canadian plant to be established at Walkerville, Ont.

George M. Laughlin III has been elected a director of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

A. M. Lally, Pittsburgh District Manager of Sales for the National Tube Co. for a number of years, has just retired under the United States Steel Corporation pension plan.

John M. Lessells, formerly manager of the Mechanics Division of the Research Laboratory, East Pittsburgh, of the Westinghouse Electric & Manufacturing Co., has been appointed manager of engineering at the South Philadelphia Works of the company, to succeed A. D. Hunt, resigned.

M. B. MacNeille, formerly designing engineer of centrifugal pumps, chief engineer of the hydraulic division, and for the past six years manager of the pump division of Fairbanks, Morse & Co., Chicago, has resigned to become Western sales manager of the Dayton-Dowd Co., manufacturer of centrifugal pumps, Quincy, Ill., with headquarters in San Francisco.

F. W. Miller, formerly vice-president of Rogers Brown & Crocker Bros., Inc., has been appointed vice-president of the Swann Chemical Co. He will have charge of the Cincinnati office in the Carew Tower.

J. H. Morris was elected secretary of the Inland Steel Co. at a meeting of the board of directors recently. He succeeds W. D. Truesdale, who has served as secretary and treasurer. Mr. Truesdale remains treasurer.

E. L. Ryerson, Jr., President of Joseph T. Ryerson & Son, Inc., Chicago, has been chosen to represent the American Engineering Council on the Advisory Board of the Museum of Science and Industry in the City of New York.

Severin Seaberg, one of the founders of the Harrington Seaberg division (Moline, Ill.) of the Gamewell Corporation, and general manager of the division, has resigned and been succeeded by H. I. Turner. Mr. Turner came to Moline a year ago as assistant manager from the Gamewell plant in Boston.

A. J. Soper, District Manager, Montreal, of the Northern Electric Co., Ltd., was recently elected president of the Electrical Club of Montreal.

Edward R. Stettinius, who has been in charge of industrial relations for the General Motors Corporation for several years, was elected a vice-president at the organization meeting recently.

Frank Thornton, Jr., Manager of Resident Engineers in the General Engineering Department Westinghouse Electric & Manufacturing Co., East Pittsburgh, has been appointed Manager of Association Activities of the Engineering Department, to succeed R. W. E. Moore, resigned.

Alvah H. Warren, Jr., formerly assistant manager of sales at St. Paul for the Illinois Steel Co., Chicago, has been appointed manager of sales to succeed W. J. Totten.

OBITUARIES

Eli Noyes Blinn, 58, Manager of the transfer department of the United States Steel Corporation, died April 30.

Earl H. Browning, 53, Vice-President of the Ohio Gear Co., Cleveland, Ohio, died May 2 following a three-weeks illness. He was a co-founder with the late B. F. Miles and Victor R. Browning of the Browning Engineering Co., Cleveland.

Charles B. Burleigh, 69, for 40 years an electrical engineer and with the General Electric Co., and its predecessor for 46 years, died at Malden, Mass., May 6.

Frank Burns, 86, retired armorer and one time superintendent of the Parrott Gun Works which produced cannon for the Union forces during the Civil War, died at Cold Spring, N. Y., April 30.

Grant H. Crennell, 44, Superintendent of the Columbia Steel & Shafting Co.'s plant at Carnegie, Pa., died April 24 at Crafton, Pa.

Sen. George G. Foster, 71, Vice-President of Armstrong-Whitworth of Canada, died in Westmount, Que., May 1. Senator Foster was also vice-president of the Orford Mountain Railway Co., and the St. Lawrence Power Co., Ltd.

Paul Hackendahl, 83, one of the founders of the Hackendahl & Schmidt Co., Milwaukee, died April 26. His only son, William Hackendahl, has since been president and manager.

Charles M. Holbrook, 73, for many years purchasing agent of the National Transit Pump & Machine Co., Oil City, Pa., died April 28.

Daniel S. Hoover, 64, Vice-President of the Clark Car Co., Pittsburgh, was asphyxiated in a garage in Ridgway, Pa., on May 1.

Charles Isaacson, 57, a founder and treasurer of the Milwaukee Flush Valve Co., Milwaukee, Wis., died April 25 following a month's illness.

David Peter Johnston, 65, President of the Western Screw Manufacturing Co., Chicago, died April 20.

George W. Kyburg, 69, treasurer of the Package Machinery Co., Springfield, Mass., died April 30 in Springfield. Mr. Kyburg became treasurer of machinery company when it was organized in 1913. He retired from active work several months ago because of ill health.

Winfield V. Mayne, 43, Secretary and Manager of the Wickham Bridge & Pipe Co., Council Bluffs, Iowa, died in the Atlantic (Iowa) hospital, April 29, as a result of injuries received in an auto accident near Anita.

Wilbur S. McIntyre, 64, founder and president of the Welland Iron & Brass Co., died recently at his home in Welland, Ont., following a two-year illness.

A. Johnson Monroe, 51, associated with his father and his brother in N. S. Monroe & Sons, Arthur, Ill., manufacturer of roadmaking machinery, died April 27 after a month's illness.

William T. Norton, 51, designer of the war-time Liberty truck, and since 1923 a consulting automotive engineer in Cleveland, died recently there.

William F. Prier, Founder and President of the Oregon Brass Works, Portland, Ore., died recently.

Charles H. Whitaker, 65, former sales manager of the Manitoba branch of the Massey-Harris Co., Ltd., died at Winnipeg April 28. He joined the company in eastern Canada, and in 1901 was appointed assistant sales manager in Toronto, moving to Winnipeg in 1904. He retired in 1926, after 45 years' service.

FORTHCOMING MEETINGS

AMERICAN STEEL & HEAVY HARDWARE ASSOCIATION — Twenty-second Annual Convention, May 18-20, William Penn Hotel, Pittsburgh. B. R. Sackett, 505 Arch St., Philadelphia, secretary.

NATIONAL FOREIGN TRADE COUNCIL —Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

Fourth New England Meeting, Hartford, Conn., June 1-4.

National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

AMERICAN MANAGEMENT ASSOCIATION—Annual Conference, Production Division, Rochester, N. Y., June 1-2. Headquarters, 20 Vesey St., N. Y. C.

NATIONAL ASSOCIATION OF PURCHASING AGENTS—Annual Convention and Informashow, Royal York Hotel, Toronto, Canada, June 8-11. G. A. Renard, 11 Park Place, New York.

NATIONAL ASSOCIATION OF FOREMEN —Eighth Annual Convention, Biltmore Hotel, Dayton, Ohio, June 12-13. Detailed information from the National Association of Foremen, Refiners Bldg., Dayton, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS —Summer meeting, June 14-19, White Sulphur Springs, Va. Green Brier Hotel. J. A. C. Warner, secretary, 29 West 39th St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., N. Y. C.

NATIONAL METAL CONGRESS AND EXPOSITION — Exposition on Commonwealth Pier, and Congress sessions at Hotel Statler, Boston, Mass., week of Sept. 21. Information from W. H. Eisenman, Secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

NATIONAL SAFETY COUNCIL—20th Annual Safety Congress, Chicago, Oct. 12-16. Details from headquarters, Civic Opera Bldg., Chicago.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

DULLNESS seems the order of the day in machinery and machine-tool centers, with increasing evidence that general business is not yet ready to rouse itself from its lethargy. Sales of tools are now principally to Government, national, state, or municipal, to school boards, the Navy department and other sources ordinarily not considered important. Prices are, however, holding steady, and there are indications here and there of increasing activity.

NEW YORK'S market was generally quiet, except for several small sales and a 20-tool school inquiry. General Electric purchased a pair of smaller lathes to accompany the $55,000 unit purchased last week. Chicago also reports dullness, except for closings on the recent railroad inquiries and a 24-lathe inquiry of the school board there. Detroit feels confident that automotive improvement will result in orders for tools immediately, but the disappearance of the used-car problem is being hailed hopefully. Cincinnati is just about holding even, both in manufacturing and selling, with no feature in the offing. New England reports a mixed trend, some industrial centers going up, others falling off. There, as in other centers, used tool demand is slow, even at greatly reduced prices.

INDIANAPOLIS has some automotive business, mostly from outside, and light railroad demand, and a fair number of sales of general machinery. Canada, conversely, reports continuing improvement, both in general conditions and in tool sales. All branches of industry are gaining there, with a definite upturn in tool orders and inquiries resulting. Pacific Northwest is spotty.

NEW YORK

Closing of bids on the 20-tool list for the Bloomfield (N. J.) high school this Monday, and a few miscellaneous sales were the only features in an otherwise quiet machine tool market. One dealer sold several tools to the New York *World-Telegram*, also a couple of lathes to General Electric to accompany the $55,000 lathe purchased the preceding week. Inquiries come in spurts and are considered of little importance; any major change must come from the re-awakening of general business. Several big orders were reported, among them the awarding of the electrical equipment for Hoover Dam to Westinghouse. Alco Products has received a Soviet order for $1,250,000 worth of oil refining equipment.

CHICAGO

Continued dullness characterizes machine tool and machinery markets. There appears to be no appreciable improvement in the business situation, and the generally expressed opinion of leaders is not reassuring as to the outlook. Inquiries are comparatively few in number, and such little demand as exists is for absolute necessities. An occasional inquiry for one or two used tools is reported, but closing, even at greatly cut prices, is slow. No further inquiries from railroads are noted. Buying against railroad lists in the hands of the trade is said to be progressing satisfactorily, and it is believed that within the next few weeks closing on most items will have been effected. Industrialist interest in the market shows no improvement. The only inquiry of importance this week comes from the Chicago Board of Education and calls for prices on twenty-four 5-ft. x 13-in. motor-driven lathes, needed by the Austin High School. This is practically a repetition of last year's inquiry, increased by six units, for the same school, on which no action was taken. The Board also is asking prices on a hand shaper and a variety of parts and accessories for three other Chicago high schools.

DETROIT

The optimism that has been in such marked contrast to sales reports has begun to disappear. Machinery and machine tool dealers are taking a more depressed view of things than they have in many months and with only a few exceptions they are disappointed over the showing made in the first four months of the year.

Orders have been scarce since December; more scarce than the average dealer would care to admit. There were inquiries, however, and the feeling persisted that these inquiries would lead to purchases. Thus far this has not been the case. Only a scattering few orders have been received and these are not at all significant.

One of the most encouraging signs on the business horizon is the disappearance of the used car problem. Hundreds of thousands of cars have been sold and junked, and as a result the way has been cleared for the sale of new cars in the near future.

CINCINNATI

A few machine tool manufacturers found the business pulse a little weaker in the past week, while others note no change in the demand. Selling agents garnered a few small orders and developed some prospects. The week's sales were largely confined to single items, principal buyers being general machinists and miscellaneous industrial users. Such business as was booked was well diversified and well scattered over the different sections of the country. A few manufacturers had a slight increase in the number of inquiries received, and others had about the same number as they have been getting for some time. These were well scattered and well diversified, and in the main the requirements were single pieces of equipment for replacement.

NEW ENGLAND

Little action is reported in New England territory. Machine tool business is wrapped in tranquility. Indications are that it will be some time before the March peak will again be reached. Orders are for single machines, and this volume, with a fair distribution of tools, constitutes all there is to talk about. Dealers in rebuilt equipment report only occasional orders.

Industrial conditions improve in some centers, while recessions are reported in others. Due to government orders, the aeronautical field is rather active. This week Pratt & Whitney Aircraft, Hartford, received orders for 202 airplane engines totaling $1,150,000. Sikorsky, Bridgeport, has under construction two 46-pass. planes designed for trans-Atlantic mail service, planned by the Pan-American Airways, Inc. The grinding industry is less active.

INDIANAPOLIS

No improvement is seen in local demand. There are inquiries from some widely scattered sources, but the trade is finding it very difficult to close orders. Some doubt is expressed as to when the industrials will begin buying. There is a slight improvement in the automobile demand, but most of it is in factories outside of Indianapolis. The local situation is somewhat demoralized.

Railroad buying continues very light. There are no lists out in the local field, but there is some increase in employment in the various shops. Some sales are being made to road contractors for special equipment consisting mostly of concrete mixing machinery and road rollers. This business is not expected to hold up long. Some demand is coming from refrigerator factories, particularly the automatic refrigerator companies. It is said demand from this source is heavier than at this time last year.

A fair volume of new equipment is being sold to the crushed rock and gravel plants. Dealers in second-hand machinery say there is some inquiry, but buyers seem to feel they should have prices all out of proportion to the general situation.

CANADA

The market for machinery and machine tools continues to widen with the general improvement in industrial conditions. A number of the leading tool manufacturers report actual sales during April considerably in excess of the previous month and inquiries now being received point to a fair volume of business during the next three or four months. Steel mills are becoming more active, and gains have been noted in construction, particularly in the Prairie Provinces, with a resultant increase in the sales of structural steel and industrial machinery. Railway equipment shops and shipyards are moderately busy.

The automotive industry is steadily gaining; manufacturers in some centers find orders ahead of production. Agricultural implement sales continue dull, although manufacturers believe that prospects are better than they were at this time last year. Electrical manufacturing firms are well employed and there is every prospect of business in this line being well maintained throughout the spring and summer.

PACIFIC NORTHWEST

The market is spotty, some lines being fairly active, others at low ebb. As a whole, conditions show no marked improvement over February and March. Demand for road machinery and equipment used in public works, such as drills, compressors, pumps, and air machinery is almost normal, but houses catering to industrial plants and machine shops find business disappointing and below normal spring levels. Precious metal mining is active, but low-grade properties are unable to operate as a rule under present conditions. Commercial machine shops and automobile plants, requiring precision tools, are buying sparingly. The cannery outlook is pessimistic. Not more than 50 per cent of capacity, either fish or fruit plants, will operate this season and the volume of tool business has been correspondingly low. Lumber and logging are not reviving and this depression is reflected among machine tool and shop equipment houses. Foundry activity is not increasing. Lumber output is less than 45 per cent of capacity, and houses dealing in wood-working equipment are doing little business. The Puget Sound Navy yard has opened bids for two radials, and specifications are out for boring and drilling machinery and other equipment. No action has been taken by the Navy on bids submitted for equipment for the Sand Point, Seattle, aviation station.

BUSINESS • BAROMETER

Europe will supply the motif for the next act in economic history; America needs a change in mental attitude

THEODORE H. PRICE
Editor, Commerce and Finance, New York

LAST week was an anti-climax to the same period in 1929. During the month of May in that year, official Washington, including the Secretary of the Treasury, could see nothing in the way of our continued prosperity. Prices were rising, and it was said that the indications favored a further advance. Eight or nine per cent was being paid for money on call, but its cost did not seem to make any difference, and the country was for the most part cheerful and optimistic.

But by September a change had set in. The stock market had commenced to lose its buoyancy, and in October, 1929, the present depression had commenced. Apparently it still continues. Last week Secretary Mellon gave out what seemed to be a distinctly pessimistic interview. Various statistical statements showing a depreciation of many billions in the value of American securities were published, and several staple commodities made new low records. This was particularly true of the metals. A trade report says:

"Zinc dipped to the bottom level since 1896; lead coincided with the lowest price of 1921; the copper market dropped to the lowest point reached in this decline, lower than it reached in 1895. On the National Metal Exchange both copper and tin tobogganed to the lowest levels in the history of this exchange, which dates from December 3, 1928."

Agricultural commodities danced to the same melancholy tune. Coffee declined because the wisdom of the export duty that Brazil intends to levy is coming to be doubted. Sugar seems to have lost its stimulus. Corn has been steadier.

As against this somewhat gloomy background a distinct improvement in the automobile industry is to be noted, and there are one or two other industries, including shoe, and leather and lumber, that show a slight improvement. Railroad earnings are also commencing to pick up a little, but the figures are not convincing, as they compare with those of April, 1930, when the effect of the business depression upon transportation was beginning to be felt. About the best that can be said for the building industry is that it is maintaining recent levels. Steel production in April fell 221,000 tons below that of March; there was a net loss of three blast furnaces active in the month, and a decline in U. S. Steel unfilled orders is anticipated.

The New York Federal Reserve Bank has reduced its discount rate to 1½ per cent, the lowest in the history of the Federal Reserve System. The Boston reserve bank reduced its rate from 2½ to 2 per cent and the Philadelphia and Dallas banks reduced their rates from 3½ to 3 per cent.

To analyze the causes for the gloom that prevails seems hardly necessary. That is not the way to re-attain prosperity. In so far as our material resources and opportunities are concerned they differ but little from last year's or those of 1929. The prevailing pessimism seems entirely a psychological condition. To his neighbor Mr. Smith, Mr. Jones says, "It looks like hard times, doesn't it?" Mr. Smith replies affirmatively, and the whole community is soon talking about the business depression that Mr. Smith and Mr. Jones have observed. A feeling of apprehension is aroused. It is suggested that this or that concern may be over-extended, and forced to suspend. There is no basis for this thought except the casual remark that Mr. Jones made to Mr. Smith, and there seems to be no way of stopping these insidious rumors. They simply have to wear themselves out. This is what now appears to be happening. There is much talk of business embarrassment, but failures are not as numerous as they were, and up to date the banks have been able to supply credit to all those who were entitled to it.

The time for a change in feeling seems to be approaching, and it may arrive sooner than many of the pessimists expect. The most rigorous investigation fails to disclose any basis for the rumors in circulation last week. Of course, there may be some failures or suspensions, but they occur even in good times, and preparation for a business revival that may come sooner than anyone expects is advised.

In Europe a distinct improvement seems to be making itself felt. This is particularly true of England where the repercussions of Chancellor Snowden's budget speech are commencing to be felt throughout the political as well as the economic world.

Some economic idealists predict that the tariff walls which now separate the various nations of Europe will soon be destroyed, and so open a new free trade area to human enterprise. Lloyd George gave projectile power to this idea when he asserted that the United States was the largest free trade area in the world. Among the political economists of Europe the subject has attracted renewed widespread attention and it may have a more important effect upon the world's foreign trade than many now assert.

At all events it is becoming increasingly clear that Europe will supply the motif for the next act or scene in the world's economic history, and a return of prosperity in this country is almost entirely dependent upon a change in our mental attitude.

THE BUSINESS WEEK

May 13, 1931

The curious economic coma continues. . . . Weekly fluctuations in the patient's pulse are slight and insignificant. . . . Our index remains frozen at the depression level of the past five months. . . . The decline in steel activity is slow and no more than seasonal, and there are no signs of marked change in demand. . . . The same static condition persists in electric power production, in check payments, currency circulation and merchandise carloadings. . . . A few faint favorable flickers are seen in a rise in residential building at the close of April and in some slight strengthening of wheat prices and bond markets. . . . Most commodities, however, continue to weaken and stocks drift indecisively downward. . . . The foreign picture shows no improvement. . . . Domestic and national business conferences come to a close without large-scale constructive accomplishment. . . . The Federal Reserve authorities are pushing aggressively their policy of forcing lower short-term money rates, but the effort is more academically interesting than immediately encouraging. . . . Ultimately and in the extreme application, the easy money invitation to business initiative will doubtless prove effective, but ultimately also, the depression will disappear of itself. . . . Pressure is needed to speed the process.

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THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

ABOUT the only avenues of demand offering any signs of improvement in the current market for metals, are rails, line-pipe and tank-plates. Southern pig-iron production is beginning to out-step demand although prices hold. The non-ferrous scrap market, especially at New York, appears practically lifeless. Linseed oil is up 0.1c. per lb., to 9.7c. at New York, representing the only advance of the week in the materials listed here. Declines occurred in copper, tin, lead, zinc, scrap, and fabricated brass and copper.

(All prices as of May 8, 1931)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.19@$14.69
Tenn. Foundry (Silicon, 1.75@2.25)	14.19@ 14.69
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	19.91@ 20.41
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	12.00@13.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	18.26@18.76
Virginia No. 2 (Silicon, 1.75@2.25)	22 29
Basic	17.00@17.25
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.01
PITTSBURGH:	
No. 2 Foundry	17.50
Basic	17.00@17.50
Bessemer	17.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4.75
Chicago	4.50@4.75

STEEL SHEETS—Prices are in cents per lb. for sheets from warehouse stock except at Pittsburgh mill, where prices apply on large lots:

Blue Annealed*	Pittsburgh Mill	Chicago	Cleveland	New York
No. 10	1.85@1.90	3.35†	3.00	3.20‡
No. 12	1.90@1.95	3.45†	3.10	3.25‡
No. 14	2.00@2.05	3.55†	3.20	3.30‡
No. 16	2.10@2.15	3.65†	3.30	3.40‡
Black				
Nos. 18 to 20	2.05@2.15	3.60†	3.40	3.30
No. 22	2.20@2.30	3.75†	3.55	3.45
No. 24	2.25@2.35	3.80†	3.60	3.50
No. 26	2.35@2.45	3.90†	3.70	3.60
No. 28	2.50@2.60	4.05†	3.85	3.75
Galvanized				
No. 10	2.10@2.20	3.65†	3.20	3.35
Nos. 12 to 14	2.20@2.30	3.75†	3.40	3.40
No. 16	2.30@2.40	3.85†	3.50	3.50
No. 18	2.40@2.55	4.00†	3.65	3.65
No. 20	2.60@2.70	4.15†	3.80	3.80
No. 22	2.65@2.75	4.20†	3.85	3.85
No. 24	2.80@2.90	4.35†	4.00	4.00
No. 26	3.05@3.15	4.60†	4.25	4.25
No. 28	3.30@3.40	4.85†	4.50	4.50

*Light Plates. †400 to 3,999 lb. ‡1,000 to 3,999 lb., ordered and released for shipment at one time.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt..	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap..	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

List prices on which foregoing discounts apply, are as follows:

Size, Inches	List Price per Foot	Diameter in Inches External	Diameter in Inches Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.275	1.9	1.61	.145
½	.37	2.375	2.067	.154
⅝	.585	2.875	2.469	.203
¾	.765	3.5	3.068	.216
⅞	.92	4.0	3.548	.226
1	1.09	4.5	4.026	.237
1¼	1.48	5.563	5.047	.258
1½	1.92	6.625	6.065	.28
2	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness		Outside Diameter in Inches						
		½	⅝	¾	⅞	1	1½	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049	18	.17	.18	.19	.20	.21	.23	.25
.065	16	.19	.20	.21	.22	.23	.25	.27
.083	14	.20	.22	.23	.24	.25	.27	.29
.095	13	.21	.23	.25	.26	.27	.29	.31
.109	12	.22	.24	.26	.27	.28	.30	.32
.120 or								
.125	11	.23	.25	.27	.28	.29	.31	.33
.134	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered bessemer rods	7.00	6.00	6.15
Hoop steel	3.55†	4.00	3.65†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.65†	5.00	5.00†
Cold fin., round or hexagon	3.40	3.40	3.35
Cold fin., flat or square	3.90	3.90	3.85
Structural shapes	2.90†	2.95	3.00†
Soft steel bars and bar shapes	2.90†	2.95	2.90†
Soft steel bands	3.20†	3.20	3.10†
Rivets, structural or boiler	4.00	4.00	4.00
Tank plates	2.90†	2.90	3.00†
Bar iron (2.75 at mill)	2.90	3.00	2.90†
Drill rod (from list)	65%	55%	60%

*Flat, ⅜-in. thick by ½-in. wide. †Minimum, Chicago, 400 lb., New York, 1,000 lb., ordered and released for shipment at one time.

Electric welding wire at New York warehouse—$\frac{3}{32}$, 8.35c. per lb.; ⅛, 7.85c. per lb.; $\frac{5}{32}$ to ½, 7.35c. per lb.

METALS

Warehouse prices in cents per lb. for small lots:

Copper, electrolytic, New York			10.50
Tin, Straits, pigs, New York			25.00
Lead, pigs, E. St. Louis	3.80	New York	5.00
Zinc, slabs, E. St. Louis	3.25	New York	4.50

	New York	Cleveland	Chicago
Antimony, slabs	10.00	10.00	10.75
Copper sheets*	19.12½	19.37½	19.37½
Copper wire*	11.25	11.00	11.37½
Copper, drawn, round*	18.37½	18.37½	17.87½
Copper tubing*	22.37½	21.87½	21.87½
Brass sheets, high*	17.12½	16.75	16.75
Brass tubing, high*	22.00	21.62½	21.62½
Brass rods, high*	15.37½	15.00	15.00
Brass wire, high*	17.25	17.25	17.25

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%, f.o.b.	24.00	24.30	23.30
Zinc sheets (casks)	9.00	10.50	10.36
Solder (½ and ½)	20.87½	21.50	18@20

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade	43.50
Commercial genuine, intermediate grade	33.25
Anti-friction metal, general service	28.50
No. 4 babbitt, f.o.b.	9.50

NICKEL AND MONEL METAL—Prices in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	7.00	7.50	6.75@ 7.25
Copper, heavy, and wire	6.75	7.00	6.25@ 6.75
Copper, light, and bottoms	5.75	6.00	5.50@ 6.00
Heavy lead	2.75	3.25	2.50@ 3.00
Lead battery plates	1.12½	2.00	1.75@ 1.87½
Brass, heavy, yellow	4.00	4.25	4.00@ 4.25
Brass, heavy, red	6.00	6.75	5.75@ 6.25
Brass, light	3.00	3.25	3.25@ 3.75
No. 1 rod-brass turnings	4.00	4.50	4.00@ 4.50
Zinc	1.00	1.50	1.25@ 1.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07@$0.11	$0.13	$0.13
Cotton waste, colored, per lb.	.05½@.09	.09	.09
Wiping cloths, colored, per lb.	.10	.08	.09
Sal soda, per lb.	.01¾	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.097	.099	.102
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.75	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.35	.36	.24
Belting—Discounts from list:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30-10%	30-10%	50%
Med. grade, heavy wgt.	30%	30 -5%	40%
Rubber transmission—List price. 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	60-10-10%	50-10%	60%
Second grade	70-10%	60- 5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.029	$0.029	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.1537½	.1587½	.1875
Solder (½ and ½)	per lb.	.2087½	.2162½	26.25
Cotton waste, white	per lb.	.07@.11	.07@.11	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.75	.75	.75
Machine oil	per gal.	.35	.33	.33
Belting, leather, medium	off list	30-10%	30-10%	30-10%
Machine bolts, up to 1x30 in., full kegs	off list	65%	65-10%	50-10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton		Connellsville,	2.50
Coke, prompt foundry, per net ton		Connellsville,	3.25
White lead, dry	100 lb. kegs	New York,	13.25
White lead, in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*Less than 3 reams. †Less than 200

SHOP SUPPLIES

Discounts from list, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65%
Larger, up to 1 x 30-in., full kegs, list less	65%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65%
Larger, list less	65%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.00
Structural, round head, broken kegs, net	4.50
Tank, ⅞-in. dia. and smaller, list less	65%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65%
Larger, up to 3-in., list less	65%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20-10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$9.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Mass., Swampscott — Town. H. S. Baldwin, Chn.—metal and woodworking equipment for proposed 2 story school on Forest Ave. Estimated cost $350,000.

T. H., Pearl Harbor — Bureau of Yards & Docks, Navy Dept., Washington, D. C.—will receive bids until June 10 for a 30 ton revolving crane at Naval Operating Base here.

Opportunities for Future Business

Ala., Birmingham—Gledhill Road Machinery Co. of Ohio, will build a 90 x 300 ft. plant for the manufacture of road machinery. Estimated cost $150,000. W. V. Goshorn, F. W. Faber and others are interested.

Ark., Everton—Silica Products Co., Inc., c/o D. D. Dunkin, Harrison, is having preliminary plans prepared for the construction of a silica products plant here. Estimated cost $75,000. Private plans. Work will be done by owner's forces.

Calif., Burbank—United Airports Co. of California, Ltd., awarded contract for the design and construction of a 30 x 240 ft. machine shop. Estimated cost $50,000. Western Air Express, lessee.

Calif., Emeryville — Paraffine Co. Inc., 475 Brannan St., San Francisco, awarded contract for the construction of a linoleum factory here. Estimated cost $50,000.

Calif., Los Angeles—Auburn-Fuller Co., c/o A. C. Martin, Higgins Bldg., Archt., is having plans prepared for a 1, 4 and 5 story, 140 x 195 ft. automobile sales and service building at Wilshire Blvd. and Mariposa Ave. Estimated cost $200,000.

Calif., Los Angeles—Pacific Coast Steel Corp., 215 Market St., San Francisco, acquired a 17 acre site and plans plant expansion to include open hearth, angle mill and enlarge forge pressing facilities at Slauson Ave. and Atlantic Blvd. here.

Calif., Los Angeles—Pacific Hardstone Brick Co., 416 West 8th St., plans the construction of a new plant to include machine shop, etc. Estimated cost $70,000.

Calif., San Rafael—U. S. Government, c/o Capt. H. B. Nurse, plans construction program which will extend over a period of three years, including 125 houses for commissioned officers, 55 duplex houses for non-commissioned officers, five 2 story barracks buildings, warehouses, shops, etc., at Bombing Base. Estimated cost $5,000,000.

Calif., Woodland — J. W. Bird Co., H. C. Schrader, Gen. Mgr., plans a 1 story plant for the manufacture of deep well pumping machinery. Estimated cost $35,000.

Conn., West Hartford—Smith & Jessen, Park Rd., West Hartford, are having plans prepared for the construction of a 1 story, 35 x 108 and 35 x 55 ft. shop, garage, etc., on Park Rd. Estimated cost $40,000. W. P. Crabtree, Jr., 252 Asylum St., Hartford, Archt.

D. C., Washington—Treasury Dept., Office of the Supervising Architect, will receive bids until May 28 for the construction of a 240 x 480 ft. garage.

Ill., Chicago — Motorists Association of Illinois, 3254 South Michigan Ave., awarded contract for the construction of a 29 story club and motorists hotel at 24th St. and Michigan Ave. Estimated cost $1,500,000.

Ill., Peoria—Bd. of Education, E. C. Fischer, Supt., will receive bids about July 1 for the construction of a 2 and 3 story, 250 x 450 ft. junior high school including four shops, etc. Estimated cost $800,000. Hewitt, Emerson & Gregg, Peoria Life Bldg., Archts. and Engrs.

Ind., Anderson—Bickett Rubber Products Co., Watertown, Wis., moving plant to Anderson to be located at West 25th St. and Martindale Ave. Plant will be reconditioned and new machinery added.

Ind., Fort Wayne — Moynshan Construction Co., Union Title Bldg., awarded contract for a 3 story service building, repair shop and garage. Estimated cost $400,000.

Ia., Maquoketa—Maintenance Superintendent, D. W. Burch, 339 Old Masonic Temple, Davenport, will receive bids until May 22 for the construction of a maintenance garage here.

La., New Orleans—Bates Valve Bag Co., 60 East 40th St., New York, N. Y., plans a 100 x 240 ft. branch plant for the manufacture of heavy paper containers here. Estimated cost $150,000.

Mass., Holyoke — Bd. of Public Works, awarded contract for the construction of a 3 story, 150 x 235 ft. vocational school on Beech St. $133,780.

Mass., Melrose—Eastern Massachusetts Street Railway Co., 38 Chauncy St., Boston, will build a 1 story garage and office on Green St. Estimated cost $50,000. Private plans. Work will be done by owner's forces. Noted April 30.

Mass., Watertown — Town, E. P. Furber, Comr., Town Hall, plans the construction of a municipal garage. Estimated cost $75,000. Architect not selected.

Mass., Worcester — Northeastern Storage & Distributing Co., J. S. Gerety, 93 Grafton St., is having plans prepared for the construction of a 180 x 640 ft. warehouse terminal at Artic, Grafton and Keefe Sts. Estimated cost $900,000. J. Hoffman, 147 East 61st St., New York, Archt.

Mass., Worcester—Union Bus Terminal Corp., c/o A. J. Smith, 58 Front St., Archt., plans the construction of a bus terminal on Salem Sq. Estimated cost to exceed $50,000.

Mich., Ann Arbor—American Broach & Machine Co., awarded contract for the design and construction of 1 story, 40 x 92 ft. addition to plant. Estimated cost $25,000.

Miss., Laurel — Masonite Corp., plans a 1 story addition to plant for the manufacture of wallboard products. Estimated cost to exceed $60,000.

Mo., Kirkwood—State Highway Commission, Jefferson City, will receive bids until May 21 for the construction of a garage and office. T. H. Cutler, c/o State Highway Comn., Engr.

N. J., Roselle—Hubeney Bros., 615 East First Ave., will not construct 1 story addition to machine shop on East First Ave. $40,000. W. L. Finne, 1201 East Grand St., Elizabeth, Archt. Project abandoned. Noted Feb. 19.

N. J., Trenton — C. V. Hill & Co., 360 Pennington Ave., awarded contract for a 1 story, 100 x 250 ft. factory. Estimated cost $45,000.

N. Y., Brooklyn—S. Marinello, 2783 East 27th St., plans the construction of a 1 story, 100 x 100 ft. service garage at Ralph Ave. and Canarsie Lane. Estimated cost $40,000 including equipment. F. C. Dehelmer, 8761 24th Ave., Archt. Indefinite when bids will be taken. Noted April 30.

N. Y., Brooklyn—F. Nyse, 149 Van Dicklen St., plans the construction of a 1 story, 102 x 156 ft. service garage at Lake St. and Ave. S. Estimated cost $40,000. W. Richter, 301 Elmwood Ave., Archt. Maturity late in August. Noted April 30.

N. Y., Brooklyn—M. Rubin, 430 5th Ave., plans the construction of a garage and auto laundry at Coney Island Ave. and Ave. N. Estimated cost to exceed $40,000. A. A. Blaustein, 1102 Kingshighway, Archt. Maturity about August. Noted Apr. 30.

N. Y., Brooklyn—Turnschless Holding Corp., A. Schlesser, Pres., 330 Douglas St., will soon award contract for the construction of a service garage at Douglas St. and West 4th Ave. Estimated cost $40,000. W. A. Lacerenza, 26 Court St. Noted April 30.

N. Y., Brooklyn—Wooster Lumber Co., 2126 Gravesend Ave., is having sketches made for the construction of a service garage at Ave. S. and Lake St. Estimated cost $40,000. W. Richter, 301 Elmwood Ave., Archt.

N. Y., Buffalo—DuPont Cellophane Co., 2 Park Ave., New York, awarded separate contracts for addition to cellophane plant here. Estimated cost $2,000,000. Engineering Dept. of Buffalo, in charge. Noted May 7.

N. Y., Edgemere — A. Mayes, Reid Lane, Flushing, will build a service garage at Amstel Blvd. and Beach 42nd St. Estimated cost $40,000. J. Unger, 93 Main St., Flushing, Archt. Work will be done by day labor and separate contracts. Noted May 7.

N. Y., Flushing—A. Beaudel, 140-34 Brookville Blvd., Rosedale, will not receive bids for the construction of a 2 story repair shop at Brookville and Conduit Blvds. Estimated cost $40,000. Maturity indefinite. Noted April 16.

N. Y., New York — Eight Hundred Forty Barry St. Corp., 704 East 133rd St., is having plans prepared for the construction of a service garage at Barry St. and Burnet Pl. Estimated cost $250,000. P. J. Murray, 14 West 45th St., Archt.

N. Y., New York—S. Levy, Pres. Manhattan Borough, Municipal Bldg., received low bids for addition to municipal garage.

O., Cleveland—J. H. Bowie Co., 9205 Inman Ave., awarded contract for a 1 story, 48 x 77 ft. and 28 x 49 ft. machine and metal working shop. Estimated cost $35,000 including equipment.

O., Cleveland—Lempco Products Inc., J. F. Dunham Rd., manufacturer of gears, axles, brake drums, awarded contract for a 1 story, 70 x 160 ft. addition to factory. Estimated cost $100,000.

O., Cleveland—Strong, Carlisle & Hammond Co., L. J. Hammond, Pres., 1394 West 3rd St. (mill supplies and machine tool dealers), awarded contract for a 1 and 2 story, 120 x 156 ft. machine shop and storage building at 3801 St. Clair Ave. Estimated cost $100,000. Noted April 30.

O., Toledo — Constantine Casket Co., Constantine, Mich., awarded contract for a 3 story factory, storage and distribution building. Estimated cost $70,000. Mills, Rhines, Bellman & Nordhoff, Ohio Bldg., Toledo, Archts.

[illegible]rren—United States Gypsum Co., c/o J. [illegible]old, Ch. Engr., 300 West Adams St., Chicago, Ill., awarded contract for a 1 story factory for the manufacture of patented metal arch here. Estimated cost $200,000. Noted April 16.

Pa., DuBois — Kendall Refining Co., J. B. Fisher, Kendall Ave., Bradford, is having plans prepared for the construction of a 1 story service station here. Estimated cost $25,000. Bacon & Lurkey, 907 Main St., Buffalo, N. Y. Archts. R. G. Howard, Dep. National Bank Bldg., DuBois, Assoc. Archt.

Pa., Erie—Erie Resistor Corp., awarded contract for a 2 story, 32 x 56 ft. addition to plant for the manufacture of radio parts at 646 West 12th St. Estimated cost $40,000 including equipment.

Pa., Scranton — Princeton Rayons Inc., 150 Madison Ave., New York, N. Y., plans the construction of a machine shop, power house and other buildings here. Estimated total cost $250,000.

R. I., Richmond—Dept. of State Police, New Industrial Trust Bldg., Providence, is having preliminary plans prepared for a 1 and 2 story garage and police barracks. Estimated cost $50,000. Jackson, Robertson & Adams, 1216 Turks Head Bldg., Providence, Archts.

Tex., Corpus Christi—Southern Alkali Corp., subsidiary of Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa., and American Cyanamid Co., 535 5th Ave., New York, plans the construction of a plant for the manufacture of commercial chemicals here. Estimated cost $10,000,000. Private plans.

Va., Bassett—Valley Veneer Co., subsidiary of Bassett Furniture Industries, Inc., plans addition to plant to double capacity. Estimated cost $30,000.

Wash., Seattle—Bd. of County Commissioners, awarded contract for the design and construction of a 120 x 200 ft. hangar and machine shop at Boeing Field airport. Estimated cost $65,000. Noted Feb. 26.

Ont., Thorold—Ontario Paper Co., Allenburg Rd., plans additions and alterations to plant. 2 story, 50 x 144 ft. to increase capacity. Estimated total cost $500,000. John Stadler, 1117 St. Catharine St. W., Montreal, Que., Engr.

Ont., Toronto—Fairgrieve & Son, 50 Dovercourt Rd., is having plans prepared for a 2 story, 60 x 130 ft. addition to sheet metal manufacturing plant. Estimated cost $60,000. A. B. Crealock, 156 Younge St., Archt.

Ont., Toronto—Rogers-Majestic Corp., Fleet St., plans the construction of a 1 story, 44 x 56 ft. radio plant, including warehouse, etc. Estimated cost $100,000. Horwood & White, 229 Yonge St., Archts.